Chapter 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 Final Environmental Impact Statement (FEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This FEIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. Additional documentation may be found in the project planning record located at the Northern Hills Ranger District, Spearfish, South Dakota. This document is organized into seven chapters:

Chapter 1. Proposed Action and Purpose of and Need for Action: This chapter provides information regarding 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 has 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 the alternative methods for achieving the purpose and need. 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. Summary tables are included that visually display the activities planned for each alternative and provide a tabular comparison of how the alternatives respond to the issues.

Chapter 3. Existing Condition and Environmental Consequences: This chapter describes the existing condition of the Project Area and the environmental effects of implementing the proposed action and other alternatives. The analysis is organized by resource area (Fire and Fuels, Recreation, 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 FEIS.

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

Chapter 7. List of Preparers: Information on those who conducted the analysis in this FEIS.

Appendices: The appendices provide more information to support the analyses presented.

1.2 Introduction

This FEIS discloses the environmental effects of vegetation management activities proposed in the West Rim Project Area (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, and improving structural stage diversity.

This environmental analysis is tiered to:

- 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 2006a).
- The Final Environmental Impact Statement for the 2005 Phase II Amendment (Phase II FEIS) (USDA-Forest Service 2005a).
- The Record of Decision for the 2005 Phase II Amendment (Phase II ROD) (USDA-Forest Service 2005b).
- The Final Environmental Impact Statement for the 1997 Revised Land and Resource Management Plan (Revised Forest Plan FEIS) (USDA-Forest Service 1996a).

1.2.1 Project Area

The Project Area is located in the northern Black Hills immediately south of Spearfish, South Dakota (Figure 1). The Project Area includes 43,028 acres of National Forest System (NFS) lands and 10,129 acres of non-NFS lands for a total of 53,157 acres. Included in this Project Area are landmarks such as Spearfish Creek, Spearfish Canyon, Spearfish Peak, Terry Peak, Iron Creek Lake, Iron Creek and Bridal Veil Falls. The elevation of the Project Area ranges from approximately 3,800 feet at the mouth of Spearfish Canyon to 6,969 feet atop Terry Peak. Steep slopes are prevalent in Spearfish Canyon. Rolling hills, plateaus and scattered mountain peaks typify the remainder of the Project Area. Ponderosa pine is the dominant forest vegetation, but areas of hardwoods and upland meadows are interspersed across the Project Area. On NFS lands, there is approximately 34,582 acres of ponderosa pine, 3,939 acres of white spruce, 3,102 acres of quaking aspen, 748 acres of grassland, 535 acres of bur oak, 83 acres of paper birch, and 30 acres of Douglas fir.

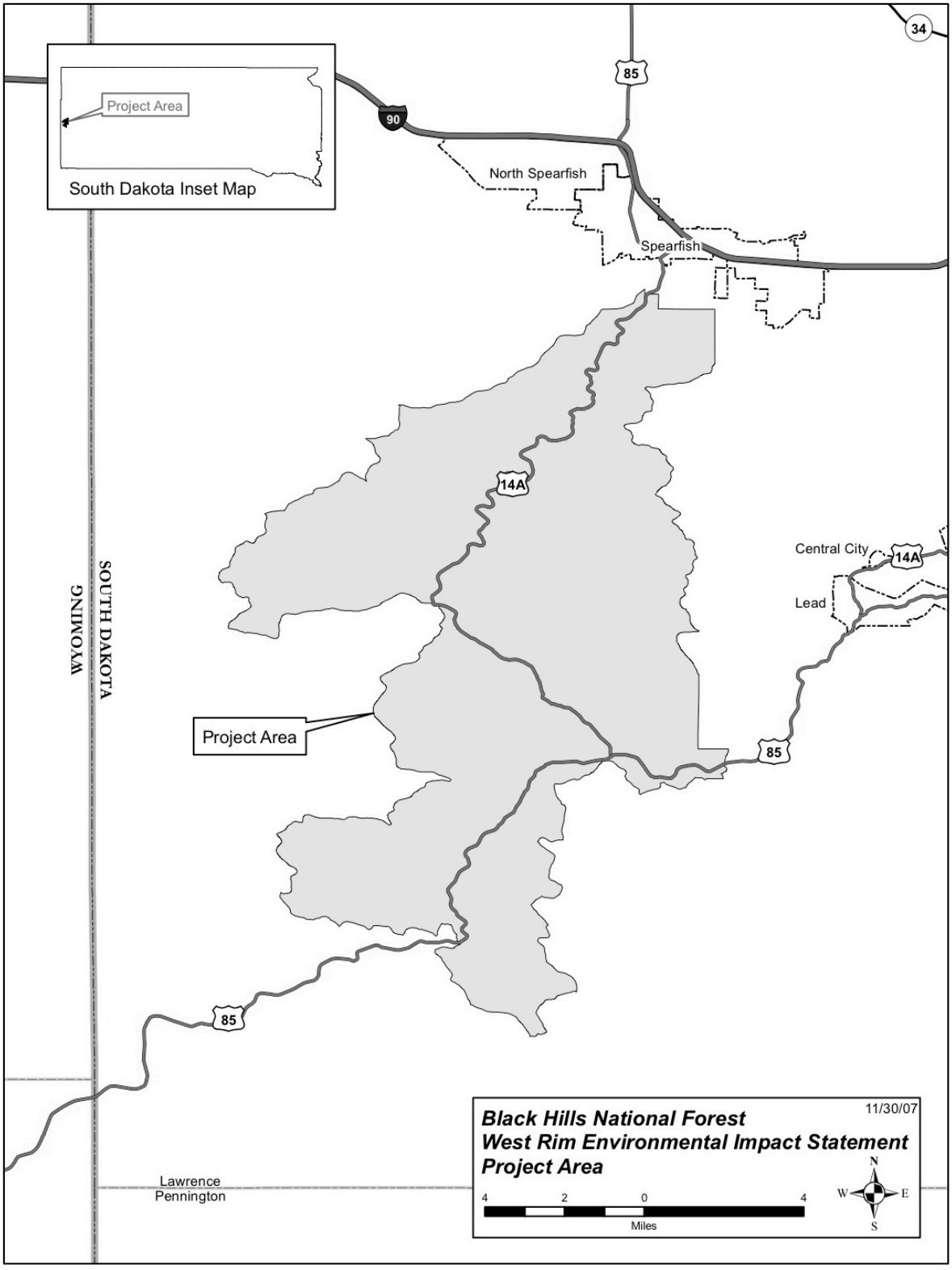

Figure 1. West Rim Project Area Location

The Project Area contains approximately 213 miles of roads on NFS land and approximately 200 miles of roads on private land. Additionally, there are approximately 45 miles of designated non-motorized trails including trails in the Eagle Cliff, Big Hill and Old Baldy systems; and approximately seven miles of designated snowmobile trails. The Project Area provides four designated picnic grounds at: Botany Bay, Long Valley, Dead Ox and Hellsgate.

The Project Area is located in Lawrence County, South Dakota, in the northern Black Hills. The Project Area includes all or portions of the lands described in Table 1.

Table 1. West Rim Project Area Legal Description[1]

Township	Range	Sections
3 North	1 East	10, 11
3 North	2 East	7, 8, 9, 12, 16, 17, 18, 19, 20, 21, 28, 29
4 North	1 East	2, 3, 26, 27, 34, 35
4 North	2 East	1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 36
5 North	1 East	1, 3, 4, 11, 14, 15, 21, 22, 23, 26, 27, 28, 33, 34, 35
5 North	2 East	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
6 North	2 East	1, 3, 4, 5, 6, 22, 23, 26, 27, 28, 31, 32, 33, 34, 35
6 North	3 East	25, 36

1.3 Background

1.3.1 Agency Direction

The Black Hills Forest Plan was revised in 1997. It has been amended twice. First by the Phase I Amendment, which provided interim direction until the more comprehensive 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.

[1] Reference to the Black Hills Meridian

1.3.2 Historical Perspective

The Black Hills has changed substantially since the Custer Expedition's discovery of gold in the area in 1874. This discovery led to rapid Euro-American settlement, which brought with it 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 disturbance regimes of this area.

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, fire regimes were different in the northern and southern Black Hills. The northern Black Hills, with its relatively wetter climate, were more susceptible to infrequent, high-severity fires, while the southern Black Hills were likely affected by more regular, low-intensity fires. Brown (2003), however, 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, the scientific consensus is 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. This can be compared to the longest fire free interval in the post-settlement era, which 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 density of the ponderosa pine forest has increased and that ponderosa have 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 2005a). Since 2000, wildfires have burned over 35,000 acres annually (USDA-Forest Service 2005a). The number of fires has remained fairly constant over time at 65-130 starts per year and the number of wildfires escaping initial attack has also remained constant; however, fires that escape initial attack have recently become larger and more difficult to control. The average size of fires over 300 acres in size has increased from less than 1,000 acres per fire in the early 1900s to over 8,000 acres per fire in recent years (USDA-Forest Service 2005a). From 1900 to 1980, large fires (those greater than 300 acres) burned about 147,900 acres in the Black Hills. Since 1980, a dramatic increase in burn area has occurred. Wildfires occurring 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 2005a).

Mountain Pine Beetles

The mountain pine beetle has become a forest health issue of concern in the Black Hills NF. 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 et al. 1994). Stressed trees, such as those in drought areas, are more susceptible to attack (Schmid et al. 1991). The likelihood of infestations in healthier trees and less dense stands increases as the overall beetle population increases.

Beetles infect trees by boring through the sapwood to lay their eggs. The beetles carry spores of the blue-stain fungus that is transmitted to the tree (Amman et al. 1989). This fungus limits the tree's sap flow and eventually kills the tree. 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 areas of ponderosa pine and have multiple effects on the associated ecosystem. These large areas 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 areas of dead trees represent pockets of readily consumable fuel that have the potential to increase fire spread and intensity. Dead trees lose their commercial value quickly. Large infestations also decrease scenic values as the dead trees support red needles for two or three years. After the needles turn brownish-red and begin to fall, areas of standing dead trees remain. Scenic values begin to improve as dead trees fall and new undergrowth becomes more visually prominent.

1.4 Purpose of and Need for Action

The Project Area includes over 10,000 acres of interspersed private land. Nearly a century of fire suppression has allowed fuels in this fire-adapted ecosystem to accumulate to dangerous levels, increasing the risk of a high-intensity wildfire threatening private property in or adjacent to the Project Area. With few exceptions, the Forest Plan calls for managing NFS land within the wildland urban interface (WUI) so that 50 to 75 percent of the area has a moderate-to-low fire hazard. For NFS land outside the WUI, the objective is to manage the land so that 50 percent of the area has a moderate-to-low fire hazard. Current conditions in the Project Area

indicate that only 15 percent of the NFS lands within the WUI and 24 percent of the acres outside of the WUI have a moderate-to-low fire hazard rating. A substantial gap exists between the existing and desired conditions for fire hazard in the Project Area.

Mountain pine beetles are native to the Black Hills. Historically, beetle populations have fluctuated on a cyclical basis, with increases in beetle activity often associated with drought conditions. Western South Dakota is currently experiencing an ongoing drought, and beetle infestations are consequently at a relatively high level. Large patches of beetle-killed trees have the potential to increase fire hazard in the short-term, decrease the aesthetics of affected areas, and can have either beneficial or detrimental effects on wildlife habitat, depending on the species. The Forest Plan recognizes that insect events are natural processes, but it also contains direction to ensure that such events are not so severe that entire stands of affected trees are killed (stand-replacing event). Preventing epidemic infestations of mountain pine beetles can be achieved by reducing the density of trees in stands of ponderosa pine. Currently, there are small pockets of known beetle activity within the Project Area. However, 65 percent of the NFS land in the Project Area has an insect risk rating of moderate or high, indicating that they are susceptible to infestation if beetles enter the area. Forest Plan direction calls for reducing the insect risk rating in stands at moderate or high risk.

The Forest Plan sets objectives for desired structural stage distributions of ponderosa pine in selected management areas (MAs) as a method of achieving a balance between fire hazard, insect risk and structural diversity, which affects the quality of wildlife habitat and aesthetic values. Four of the five management areas (MAs 4.1, 5.1, 5.4 and 5.6) that comprise the NFS land in the Project Area have associated structural stage objectives. In general terms, across these four management areas there is an overabundance of mature forest with high levels of canopy closure (structural stages 4B and 4C) and a deficit of other structural stages. This indicates a large number of dense, overstocked stands, which contributes to the fire hazard and insect risk ratings. The opportunity exists to change the structural stage distributions by managing vegetation that would contribute to moving toward the Forest-wide objectives.

Based on the information presented above, the purpose of and need for action in the West Rim Project Area is to reduce fire hazard and the risk of mountain pine beetle infestation and to increase structural diversity.

1.5 Management Direction

1.5.1 Forest Plan Goals and Objectives

The Forest Plan, as amended, supported by the final environmental impact statement (FEIS) for the revision and the Phase II Amendment (USDA-Forest Service 1996a, 2005a, 2006a), is the Black Hills NF 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 NFS lands in an environmentally sound manner.

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 for developing the Proposed Action (Alternative B). Goals 1 through 4 and 10 provide management emphasis and direction applicable to the West Rim project. These Goals are described in detail in the following sections.

The Responsible Official for the West Rim project has chosen to propose resource management actions that respond to 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 (USDA-Forest Service 2006a).

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. This project provides opportunities to maintain and improve stream health by repairing, reconstructing, or re-routing roads.

Objective 104: Maintain or enhance watershed conditions to foster favorable soil relationships and water quality.

a. *Implement projects to improve watershed conditions on an average of at least 300 acres annually over the plan period.*
b. *Achieve and maintain stable stream beds and banks, diverse riparian vegetation, and effective ground cover that controls runoff and erosion.*

The relationship between soil conditions and water quality is well documented. Existing conditions or past activities that cause disturbed soil conditions have the potential to increase erosion and adversely affect riparian vegetation, stream banks, and sediment yield. There are some watersheds in the Project Area that have natural conditions that have caused them to not fully support their beneficial uses.

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.

NFS lands in the Project Area include approximately 3,102 acres of aspen and 535 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 and bur oak 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 535 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 would 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 Project Area includes 83 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.

The Project Area includes 30 acres of Douglas fir. These stands are not proposed for treatment in this project. Lodgepole pine and limber pine are not known to occur in the 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 748 acres of meadows. Open 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 meadows. Doing so would 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 mammal 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 that 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 protect water sources.

The Project Area contains numerous riparian areas, mostly associated with perennial streams. 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 and retaining fine sediment.

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 216: Manage to conserve or enhance the integrity of the following important botanical areas:

i. Spearfish Canyon (Botanical features within Spearfish Canyon Management Area 4.2A)

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 Annie, Cleopatra (Squaw), Iron, Little Spearfish and Spearfish Creeks; and Icebox, Intake, Raddick and Rubicon Gulches. Management practices that can adversely affect fish include livestock overgrazing in riparian zones, channelization, and sedimentation from roads or other ground disturbing activities.

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

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

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

Sixteen animal species and four 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 out-competing 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 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 out-compete native plants in undisturbed sites. By out-competing native flora, noxious weeds negatively impact habitat for species that depend on a particular native plant.

Several invasive weed species are known to exist in the 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 Project Area contains areas identified as suitable plant habitat and known occurrences of sensitive species or SOLC. Severe wildfires originating outside these areas and burning across them have the potential to negatively impact the unique botanical resources within them.

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

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

MIS serve as a yardstick to determine whether management actions 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, therefore, if the indicator species experiences a decline in population 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, golden-crowned kinglets and mountain suckers exists in the Project Area. The opportunity exists to maintain or enhance habitat for these species as described elsewhere in this section.

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 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 Project Area currently includes approximately 213 miles of roads. Open road density for the Project Area is approximately 1.36 miles of road per square mile of land. 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 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.

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 Project Area contains approximately 10,129 acres of private land. All of the private lands in the Project Area have 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 and Lead, South Dakota and populated areas that include Savoy and Cheyenne Crossing, as well as the many homes with Spearfish Canyon, that a wildfire ignited in the Project Area could conceivably threaten those towns. Fire hazard reduction within these WUI areas would reduce the threat to structures and people who live within those WUI areas. The need exists to reduce fire hazard in WUI areas.

Fire hazard in the forest is most often reduced by removing fuels that would allow fires to grow large and spread quickly. This can be achieved through a variety of vegetative treatments including mechanical removal and prescribed burning. The opportunity exists in the 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.

There are three Fire Protection Assessment Compartments in the Project Area. 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". Compartment 12, Tillson, is rated low risk, moderate hazard, and low value. The overall rating of this compartment is "moderate". Based on these ratings, the opportunity exists to reduce the risk and hazard ratings for moderate to high value resource areas in the Project Area.

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

Mountain pine beetle infestations, at epidemic levels, can kill trees over large areas, which represent a high fire hazard and negatively impact 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 and small clumps in portions of the Project Area. Dense stands of ponderosa pine are at the highest risk of mortality by mountain pine beetle. The opportunity exists to decrease mortality risk due to beetles through silvicultural treatments and prescribed fire.

1.5.2 Management Area-specific Goals and Objectives

Management direction for the Black Hills NF is established in Chapter 3 of the amended Forest Plan, which divides the forest into Management Areas (MAs) that are managed with an emphasis on different resources and uses. The Project Area is comprised of five MAs (see Map A-1 in Appendix A) that are described below.

MA 4.1 (Limited Motorized Use and Forest Product Emphasis) – 4,001 acres

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

This goal calls for managing forest stands in MA 4.1 for multiple-uses. The uses that are emphasized in this MA are wood-fiber production, wildlife habitat and visual quality. Opportunities exist in the Project Area 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 a variety of potential wildlife habitat and enhances overall forest health through diversity. This variety also allows some stands to progress toward climax (old growth) conditions while creating 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 in the Project Area to accomplish this goal by treating some stands and allowing others to progress on their current successional pathway.

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)

This objective attempts to maintain a diversity of stand structure across MA 4.1 as a whole across the forest (Table 2). Current ponderosa pine structural stage distribution for MA 4.1 in the Project Area is not consistent with this direction (Table 2). Based upon the comparison of structural stages (Table 2) 1, 3A, 3B and 5 are

under-represented and 4B and 4C are over-represented. The opportunity exists to change the structural stage distributions that would contribute to moving toward the Forest-wide objectives by using a variety of silvicultural techniques to create ponderosa pine stands of varying age classes and densities.

Table 2. Percentages of Project Area MA 4.1 Structural Stages in Ponderosa Pine Compared to Forest-Wide Objectives[1]

Structural Stage	MA 4.1 Objective	Existing	Difference
1	5%	<1%	-5%
2	5%	6%	+1%
3A	10%	3%	-7%
3B	15%	<1%	-15%
3C	5%	3%	-2%
4A	25%	23%	-2%
4B	25%[2]	44%	+19%
4C	5%[2]	18%	+13%
5	5%	3%	-2%

MA 4.2A (Spearfish Canyon) – 8,819 acres

4.2A-4101. Manage fire and fuels through various methods to protect the biological and scenic values, but in the wildland-urban interface the priority will be fuel reduction. (Standard)

Spearfish Canyon is a unique resource because of the special wildlife habitat and visual quality found in this steep canyon near the city of Spearfish. Because of its unique values, it has attracted summer and permanent residences on private lands within the canyon. These residences are within the WUI and are at risk to wildfires. An opportunity exists to reduce fuels within the WUI areas surrounding these residences.

MA 5.1 (Resource Production Emphasis) – 18,678 acres

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. There is a need to manage these areas to provide for multiple uses. 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.

[1] 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 in structural stage 5 is allowed, and may be necessary, to provide desired late-successional characteristics.

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 MA 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 Project Area, however the opportunity exists to increase or enhance this variety by using 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 Project Area. The opportunity exists in the Project Area to promote shrub growth through silvicultural treatments. Removal of encroaching pine will prevent current shrub communities from being 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) See Table 3 for the Structural Stage Objectives.

This objective attempts to maintain a diversity of stand structure across MA 5.1 as a whole across the forest (Table 3). Current ponderosa pine structural stage distribution for MA 5.1 in the Project Area is not consistent with this direction (Table 3). Based upon the comparison of structural stages (Table 3) 3A, 3B, 4A and 5 are under-represented, and 4B and 4C are over-represented. The opportunity exists to change the structural stage distributions that would contribute to moving toward the Forest-wide objectives by using a variety of silvicultural techniques to create ponderosa pine stands of varying age classes and densities.

Table 3. Percentages of Project Area MA 5.1 Structural Stages in Ponderosa Pine Compared to Forest-Wide Objectives[1]

Structural Stage	MA 5.1 Objective	Existing	Difference
1	5%	1%	-4%
2	5%	4%	-1%
3A	10%	2%	-8%
3B	15%	<1%	-15%
3C	5%	1%	-4%
4A	25%	17%	-8%
4B	25%[4]	51%	+26%
4C	5%[4]	21%	+16%
5	5%	2%	-3%

MA 5.4 (Big Game Winter Range) – 1,235 acres

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

MA 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 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 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)

This objective attempts to maintain a diversity of stand structure across MA 5.4 as a whole across the forest (Table 4). Current ponderosa pine structural stage distribution for MA 5.4 in the Project Area is not consistent

[1] 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 in structural stage 5 is allowed, and may be necessary, to provide desired late-successional characteristics.

with this direction (Table 4). Based upon the comparison of structural stages (Table 4) 3A, 3B, 4A and 5 are under-represented, and 4B and 4C are over-represented. The opportunity exists to change the structural stage distributions that would contribute to moving toward the Forest-wide objectives by using a variety of silvicultural techniques to create ponderosa pine stands of varying age classes and densities.

Table 4. Percentages of Project Area MA 5.4 Structural Stages in Ponderosa Pine Compared to Forest-Wide Objectives[1]

Structural Stage	MA 5.4 Objective	Existing	Difference
1	5%	1%	-4%
2	5%	0%	-5%
3A	10%	0%	-10%
3B	15%	0%	-15%
3C	5%	2%	-3%
4A	25%	11%	-14%
4B	25%[6]	69%	+46%
4C	5%[6]	17%	+12%
5	5%	0%	-5%

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 Project Area has an open-road density of approximately 1.36 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 seasonal open-road density for MA 5.4 within the Project Area is 4.95 miles of road per square mile. 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 seasonal closure of roads.

MA 5.6 (Forest Products, Recreation and Big Game Emphasis) – 10,290 acres

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 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

[1] 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 in structural stage 5 is allowed, and may be necessary, to provide desired late-successional characteristics.

a variety of silvicultural treatments to promote different size, shape, and age class qualities in forest stands across MA 5.6.

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

Ponderosa pine encroachment represents the most serious threat to open meadow areas in the West Rim 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.

5.6-204-FC: Manage for the following percentages of structural stages in ponderosa pine across the management area in a variety of sizes and shapes. (Objective) See Table 5 for the Structural Stage Objectives.

This objective attempts to maintain a diversity of stand structure across MA 5.6 as a whole across the forest (Table 5). Current ponderosa pine structural stage distribution for MA 5.6 in the Project Area is not consistent with this direction (Table 5). Based upon the comparison of structural stages (Table 5) 1, 2, 3A, 3B, 4A and 5 are under-represented, and 4B and 4C are over-represented. The opportunity exists to change the structural stage distributions that would contribute to moving toward the Forest-wide objectives by using a variety of silvicultural techniques to create ponderosa pine stands of varying age classes and densities.

Table 5. Percentages of Project Area MA 5.6 Structural Stages in Ponderosa Pine Compared to Forest-Wide Objectives[1]

Structural Stage	MA 5.6 Objective	Existing	Difference
1	5%	<1%	-5%
2	5%	<1%	-5%
3A	10%	2%	-8%
3B	15%	1%	-14%
3C	5%	1%	-4%
4A	25%	13%	-12%
4B	25%[8]	65%	+40%
4C	5%[8]	15%	+10%
5	5%	2%	-3%

[1] 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 in structural stage 5 is allowed, and may be necessary, to provide desired late-successional characteristics.

1.6 Proposed Action

1.6.1 Development of the Proposed Action

The proposed action was developed based on the purpose and need for the West Rim project. An analysis of the Project Area, both on the ground and using GIS, showed that site conditions do not meet Forest Plan goals and objectives for fire hazard, mountain pine beetle risk or structural stage distribution in MAs 4.1, 5.1, 5.4 and 5.6. These variables are closely related, as thinning of ponderosa pine stands has been shown to both reduce fire hazard and lessen pine beetle risk. In addition, thinning stands through commercial and non-commercial timber harvest is the primary tool for altering structural stages. Further, the Forest Plan utilizes structural stage distribution as an indicator of fire hazard and mountain pine beetle risk.

A list of potential stands to be treated was developed using cover type, fire hazard, beetle risk, site suitability and past treatments. The stand list was then modified by Forest Plan direction for other resources such as wildlife, botany, fire/fuels, scenery, and hydrology/soils. Treatment prescriptions were developed based on stand-specific conditions and the necessary road network to access the proposed treatment stands was identified.

The proposed action focuses on thinning pine stands through commercial and non-commercial harvest. Many silvicultural treatments would be followed by prescribed fire to reduce fuel levels and to encourage new plant growth. The design of commercial and non-commercial harvest of pine trees in hardwood stands emphasizes prevention of the conversion of these sites from hardwood to pine. The intent of this design is to maintain or increase habitat diversity across the Project Area. The design of the treatments is intended to move the respective Management Areas toward their Forest Plan structural stage objectives, where applicable.

Prescribed fire was proposed to reduce the amount of fuels on the forest floor and to mimic natural disturbances that were part of the Black Hills ecosystem prior to fire suppression. Prescribed burns are proposed in areas both following and without prior silvicultural treatment. Burn blocks were developed to take advantage of roads and ridgetops for use as containment lines as much as possible.

The Proposed Action does not include changes to recreational opportunities or travel management due to the ongoing development of a Forest-wide Travel Management Plan, which will make such decisions.

1.6.2 Summary of Proposed Action

The proposed action includes a variety of vegetation treatments as well as development of a transportation system needed to facilitate treatments. Vegetation would be reduced using commercial timber harvest (approximately 13,379 acres), non-commercial harvest (approximately 13,713 acres), prescribed burning (approximately 13,226 acres), and fuel reduction treatments (468 acres). Stewardship opportunities, through which the Forest Service exchanges goods for services, may also be allowed under this project. All treatments would retain a portion of the stand on the site; however, there would be a variety of retained densities to provide diversity of size, age, and species structure.

The construction of new roads and maintenance of existing roads would be required to access some stands proposed for treatment. Approximately 35 miles of new construction and 126 miles of reconstruction or pre-use maintenance of existing roads would be required. All new roads constructed for this project would likely be closed following harvest activities. Existing non-Forest System roads that are identified as causing resource damage may also be closed. Road closure decisions in the Project Area would be made by the Travel Management Plan currently underway.

1.7 Decision Framework

The District Ranger, 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 West Rim 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 quarter of 2009. Most actions would be accomplished within a decade. Certain actions could last longer.

1.8 Public Involvement and Scoping

Scoping is a process of obtaining public comments about proposed federal actions to determine the range of issues regarding the Proposed Action that will be addressed by the environmental study. Comments on the proposed action, potential concerns, and opportunities for managing the West Rim Project Area were solicited from members of the public, other public agencies, tribal governments, adjacent property owners, interest groups, and Forest Service specialists. The methods used to generate comments, included:

- A postcard was mailed to approximately 1,065 landowners within or adjacent to the West Rim Project Area. The postcard informed the recipients that the scoping process would be beginning and asked that they contact the Forest Service if they would like to receive a copy of the scoping letter.
- A scoping letter was mailed to approximately 220 interested parties, including adjacent property owners, tribal members, state and federal agencies, and other organizations on September 14, 2007. 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 September 14, 2007. This release introduced the project to the public, provided a description of the Project Area, and explained the proposal. The release 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 September 19, 2007. The meeting was attended by six interested parties who met with Forest

Service officials to view maps of the area and discuss the proposed actions. Attendees were encouraged to submit comments on the proposed actions or to document their concerns associated with the Project Area.

- The Notice of Intent (NOI) to prepare an EIS was published in the Federal Register on September 14, 2007. The NOI asked for public comment on the proposal through October 15, 2007.

1.9 Issues

The Forest Service received nine comment letters during scoping. Content analysis identified specific, separate statements within each letter and categorized them. The content analysis process identified 78 comments within the nine letters. The comments were discussed and studied by the ID Team for consideration during alternative development.

Significant issues were defined as those that would be expected to have direct or indirect effects caused by implementing the Proposed Action. Non-Significant Issues were identified as those: 1) outside the scope of the Proposed Action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "... identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)..."

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

1.9.1 Fuel Reduction in Spearfish Canyon

Wildfire hazard in WUI areas and the need to reduce hazardous fuels are major public concerns in the Black Hills and in Spearfish Canyon specifically. These issues have become more prominent due to large wildfires such as Eastridge and Alabaugh that have destroyed homes in recent years. 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 NFS 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.

The Project Area lies within a heavily forested, fire-adapted ponderosa pine ecosystem that is interspersed with more than 10,000 acres of private land. Additionally, the Project Area is adjacent to other WUI areas, including the city of Spearfish, South Dakota. 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 affect numerous properties and substantially affect other values in the WUI.

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. 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 near Cheyenne Crossing

The Project Area is at endemic population levels of mountain pine beetle and includes a few outbreak areas. However, infestations are active in surrounding areas. Conditions within the Project Area make it susceptible to increasing beetle infestations. Approximately 65 percent of the ponderosa pine in the Project Area is currently at moderate or high risk of beetle infestation. With a majority of the pine at high or moderate risk, the potential for an epidemic level of infestation is a concern.

It is important to take a proactive approach in managing beetle infestations whenever possible. By conducting treatments throughout the Project Area thereby reducing stand density before pine beetles become well established, the damage they may cause in the future can be minimized. Public comments, internal Forest Service discussions, and Forest Plan direction identified consideration of mountain pine beetle risk as an important issue in the Project Area.

Although this issue is important for the Project Area, the infestation near Cheyenne Crossing falls mostly outside the Project Area and will be addressed under a separate project that focuses specifically on the infestation. See *Section 2.3.1 Mountain Pine Beetle Infestation Near Cheyenne Crossing* for more information.

1.10 Public Comments on Draft EIS

The Forest Service received 11 comment letters during the DEIS comment period. Content analysis identified specific, separate statements within each letter and categorized them. The content analysis process identified 115 comments within the 11 letters. Responses to the comments are presented in Appendix D. The following are the key public outreach pieces used during the DEIS comment period.

- The Notice of Availability (NOA) of the DEIS was published in the Federal Register on June 6, 2008. The NOA announced the availability of the DEIS to interested parties and initiated the 45-day comment

period, which ended on July 21, 2008. A legal notice announcing the availability of the DEIS and solicited comments from interested parties was published in the Rapid City Journal on June 6, 2008.

- Hard copies of the DEIS were mailed to everyone who submitted scoping comments or who specifically requested the DEIS.
- Other information sharing, communication and interaction with interested parties, agencies, and individuals occurred on a continuing basis during the DEIS comment period.

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Chapter 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 West Rim project.

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 summary of effects for the key issues presented in Chapter 1.

2.2 Alternatives Considered in Detail

This section describes activities that are proposed for each of the three alternatives.

2.2.1 Alternative A (No Action)

No actions would occur as a result of this project. Activities approved under other National Environmental Policy Act (NEPA) decisions would still occur.

2.2.2 Alternative B (Proposed Action)

This alternative was developed by the interdisciplinary team (IDT) and released to the public for scoping. The proposed action is intended to meet the purpose and need of reducing fire hazard, reducing the risk of mountain pine beetle infestation and increasing structural diversity across the Project Area.

Commercial and non-commercial timber harvest would be utilized to modify stand structure and reduce stand density. Vegetative thinning reduces fire hazard and beetle risk while altering structural stage diversity. Harvest methods would include ground based and cable logging systems, depending on terrain. Prescribed fire would also be utilized to reduce the amount of available ground fuels and to mimic natural disturbances. The

total area of treatment would be 17,363 acres within the Project Area (Table 6). The treatments are shown on Map A-2 in Appendix A and described in *Section 2.2.4 Description of Proposed Vegetation Treatments*.

Table 6. West Rim Alternative B Proposed Vegetation and Fuels Treatments

Vegetation and Fuels Treatments	Acres
Clearcut followed by prescribed burning	186
Commercial hardwood enhancement followed by prescribed burning	607
Commercial thinning to 40 BA followed by pre-commercial thinning and prescribed burning	4,149
Commercial thinning to 60 BA followed by pre-commercial thinning and prescribed burning	2,588
Commercial thinning to 80 BA followed by pre-commercial thinning and prescribed burning	59
Non-commercial hardwood enhancement	378
Non-commercial hardwood enhancement followed by prescribed burning	49
Non-commercial meadow enhancement followed by prescribed burning	37
Overstory removal followed by pre-commercial thinning	2,986
Overstory removal followed by pre-commercial thinning and prescribed burning	505
Pre-commercial thinning	166
Pre-commercial thinning followed by prescribed burning	29
Prescribed burning (broadcast burning)	2,857
Seed cut followed by pre-commercial thinning and prescribed burning	2,299
Thinning, piling and burning of natural fuels	468
Total Acres Treated	**17,363**
Total Non-commercial harvest	13,713
Total Commercial harvest	13,379
Total Prescribed Fire	13,226

Some of stands of late successional forest (structural stage 5) would be deferred from treatment while others would be actively managed. Ponderosa pine late successional forest varies in canopy structure and ground cover density; treating some stands of existing late successional forest is intended to mimic this natural diversity.

Actions are only proposed for National Forest System (NFS) land except where rights-of-way are obtained to cross private land.

Approximately 35 miles of new road construction and 126 miles of reconstruction would be required to implement the proposed treatments (Table 7 and Map A-3 in Appendix A). No roads are proposed for

decommissioning; the necessity of existing roads is being determined by the ongoing development of the Forest-wide Travel Management Plan. Likewise, no changes are proposed to off-road motorized vehicle regulations under the West Rim project.

Table 7. West Rim Alternatives B and C Proposed Transportation System Changes

Transportation System Change	Miles
New Construction	35
Reconstruction or pre-use maintenance	126
Use as is	43

The proposed action carried forward to the EIS will be modified slightly from the one that was released for scoping. Upon further review by USFS specialists, it was discovered that some of the proposed new roads would cross suitable plant habitat, sensitive snail habitat or sensitive soils. Such crossings do not necessarily represent a violation of Forest Plan standards as they can be mitigated with design criteria but, where possible, new roads were re-routed to avoid sensitive areas and minimize the overall impact. Where re-routing the roads was not feasible, design criteria are in place to minimize the effects to resources. These changes do not affect the level of vegetative treatment proposed.

2.2.3 Alternative C

This alternative was developed in response to scoping comments that raised the significant issue of further reducing fire hazard in Spearfish Canyon. Alternative C includes all the activities described under Alternative B above. In addition, this alternative adds fuel management buffers around all structures in the Project Area (not just in Spearfish Canyon; see Map A-4 in Appendix A). The fuel management buffers would extend 300 feet from all structures in the Project Area and some additional areas in Spearfish Canyon including both private and NFS lands. The total area of NFS lands within the 300-foot buffers is 568 acres, which increases the total treatment area to 18,291 acres (Table 8). An additional 760 acres of private lands are within the 300 foot buffers that would potentially be treated. The West Rim project proposes treatment on NFS lands only; any treatments on private land must be undertaken by the landowner.

Table 8. West Rim Alternative C Proposed Vegetation and Fuels Treatments

Vegetation and Fuels Treatments	Acres
Fuel management buffers	568
Clearcut followed by prescribed burning	186
Commercial hardwood enhancement followed by prescribed burning	607
Commercial thinning to 40 BA followed by pre-commercial thinning and prescribed burning	4,149
Commercial thinning to 60 BA followed by pre-commercial thinning and prescribed burning	2,588
Commercial thinning to 80 BA followed by pre-commercial thinning and prescribed burning	59
Non-commercial hardwood enhancement	378
Non-commercial hardwood enhancement followed by prescribed burning	49
Non-commercial meadow enhancement followed by prescribed burning	37
Overstory removal followed by pre-commercial thinning	2,986
Overstory removal followed by pre-commercial thinning and prescribed burning	505
Pre-commercial thinning	166
Pre-commercial thinning followed by prescribed burning	29
Prescribed burning (broadcast burning)	2,857
Seed cut BA followed by pre-commercial thinning and prescribed burning	2,299
Thinning, piling and burning of natural fuels	828
Total Acres Treated	**18,291**
Total Non-commercial harvest	14,641
Total Commercial harvest	13,379
Total Prescribed Fire	14,154

Listed below are the allowed activities and restrictions for the adaptive management fuel reduction buffers. The following activities would be allowed within the WUI buffers:

- Fuel reduction treatments can be conducted on NFS land up to 300 feet from a private structure. The exact width of the buffer zone will be determined by FS staff on a site by site basis depending on terrain, vegetation, etc, but will not exceed 300 feet (including private land) from each structure.
- Conifers that are greater than nine inches diameter at breast height (dbh) may be limbed up to 15 feet from the ground.
- Conifers that are less than nine inches dbh may be removed.

- Cut material may be piled and burned. The preferred location of piles would be private land if feasible. If piles are located on NFS land, they would be required to meet FS pile specifications; GPS points would be provided to the FS and FS crews would burn them.
- Removal or utilization of cut material would be allowed. If materials would be sold for a profit (fence poles, firewood, etc.) a permit would be required from the FS. Chipping of cut material would be allowed (see restrictions below).
- All terrain vehicles (ATVs) would be allowed to haul material provided they meet the restrictions below.
- Hazard trees greater than nine inches dbh may be removed but approval would be required from the FS prior to removal.
- Follow-up treatments to maintain buffers would be allowed under the time constraints described below.

The following restrictions would apply:

- Individuals would be required to initiate the action and submit a plan to the FS for approval. FS personnel would determine which actions are most appropriate and what buffer is necessary.
- For weed control purposes, disturbed areas would be rehabilitated/reseeded with a native mix of weed-free seed.
- Mechanical equipment (chippers, ATVs, vehicles) would be restricted to paved/gravel surfaces or frozen ground in Spearfish Canyon (MA 4.2A).
- Treatments may not be conducted on slopes over 30 percent in Spearfish Canyon.
- If chipping is conducted, chips would be removed from NFS land to retain ground litter composition.
- No new roads or trails would be constructed on NFS land.
- No commercial timber harvest (trees greater than nine inches dbh) would be allowed unless the tree is identified as a hazard, as stipulated above.
- All design criteria (Appendix B), including Watershed Conservation Practices, Watershed Impact Zone restrictions and Best Management Practices would be followed during implementation.
- Treatments would be allowed for 10 years following the signature of the Record of Decision (ROD) or until the Forest Plan is revised, whichever comes first.
- Treatment plans would be reviewed when relevant new information (e.g. new sensitive species list) becomes available or when a catastrophic event (e.g. fire, flood, wind event) occurs.

If selected and implemented, the fuel reduction activities under Alternative C would supersede the Spearfish Canyon 2 Categorical Exclusion (CE) and ongoing activities authorized under that document would cease.

2.2.4 Description of Proposed Vegetation Treatments

Clearcut followed by Prescribed Burning

The clearcut harvest followed by prescribed burning is proposed for an area of 186 acres. The objective of this proposed treatment would be to improve habitat conditions for deer and elk, and to create a fuel break. Most of the ponderosa pine greater than nine inches would be removed from these stands. Existing hardwood species would be retained including bur oak and aspen. The edges of the cut area would be "feathered" into the adjacent uncut areas to make the opening appear more natural and harvest areas would be designed so that any created opening would not exceed forty acres. These openings would be maintained with the use of repeated prescribed fire every three to ten years. This management strategy would be re-evaluated in ten years. Regeneration surveys would be required.

Commercial Hardwood Enhancement followed by Prescribed Burning

Commercial hardwood enhancement is proposed for 607 acres followed by prescribed burning. The objective of these proposed treatments would be to encourage and maintain aspen dominated stands. These treatments would remove the larger conifers from these stands and cut or hinge the smaller conifers, creating conditions favorable for the expansion of the aspen in these areas. In addition to the areas designated for hardwood enhancement, small inclusions of established aspen that are scattered throughout the ponderosa pine stands in the Project Area would be enlarged by removing pine from within and adjacent to the hardwood inclusions. Pine would be removed from the area within 30 feet of the edge of these inclusions.

Commercial Thinning followed by Pre-commercial Thinning and Prescribed Burning

Commercial thinning followed by pre-commercial thinning and prescribed burning is proposed for an area of 6,796 acres. These treatments would reduce the density of mature ponderosa pine stands to improve growth rates and reduce the risks of mountain pine beetle infestation. Commercial thinning would consist of harvesting the suppressed and intermediate pine from the stand (thinning from below), and the overmature pine from the overstory. The remaining co-dominant pine would be left at a density of approximately 40, 60, or 80 square feet of basal area per acre, depending on the stand prescription. This treatment would also include pre-commercial thinning of trees less than nine inches in diameter and prescribed burning to reduce fuels and reintroduce fire to the ecosystem.

Non-Commercial Hardwood Enhancement

Non-commercial hardwood enhancement is proposed for an area of 427 acres. Some of this area would be followed by prescribed burning. The objective of these proposed treatments would be to encourage and maintain aspen dominated stands. These treatments would remove the larger conifers from these stands and cut or hinge the smaller conifers, creating conditions favorable for the expansion of the aspen in these areas. In addition to the areas designated for hardwood enhancement, small inclusions of established aspen that are scattered throughout the ponderosa pine stands in the Project Area would be enlarged by removing pine from within and adjacent to the hardwood inclusions. Pine would be removed from the area within 30 feet of the edge of these inclusions.

Non-Commercial Meadow Enhancement followed by Prescribed Burning

Non-commercial meadow enhancement followed by prescribed burning is proposed for an area of 37 acres. The objective of this treatment is to improve meadow conditions by removing encroaching ponderosa pine trees and stimulating grass and forb growth. These areas would be burned following the removal of the encroaching conifer trees to stimulate grasses and forbs and facilitate burn unit layout.

Overstory Removal followed by Pre-commercial Thinning

Overstory removal harvests followed by pre-commercial thinning are proposed for an area of 3,491 acres (2,986 without prescribed burning and 505 acres with prescribed burning). The objective of this treatment is to complete the shelterwood regeneration process by removing most of the remaining mature overstory trees and releasing the established seedling and saplings. Most of the live pine over nine inches in diameter would be removed. However, an average of three large trees per acre would be retained to provide future snags and a seed source. These trees would be left in clumps if possible and at least one hundred feet away from roads. Existing pine regeneration would generally be protected in stands proposed for overstory removal harvest. Normally prescribed burning would not be conducted within these young stands as this treatment can result in the loss of some of the pine regeneration. However, to facilitate burning by creating burn blocks with roads for control lines, 505 acres of overstory removal would be included within the areas proposed for prescribed burning following harvest. To reduce the losses from burning, whole tree yarding would be used within these harvest areas to reduce the amount of fuel left. Log length yarding would be preferred for the overstory removal harvests that would not be burned. This yarding method combined with designated skid trails would minimize the skidding damage to the established regeneration within these stands and help to retain nutrients on the site. Post harvest activities within these harvest areas could include prescribed burning (on 505 acres), cutting cull and excess trees (pre-commercial thinning) and vegetation monitoring.

Pre-commercial Thinning

Pre-commercial thinning without a commercial harvest is proposed for an area of 195 acres (166 without prescribed burning and 29 acres with prescribed burning). The objective of this treatment is to reduce the stocking levels within young ponderosa pine stands to improve stand growth and vigor. This treatment would consist of cutting pine that are at least one foot in height and up to nine inches in diameter, leaving approximately 300 of the largest and best formed trees per acre. Prescribed burning would occur on 29 acres following pre-commercial thinning. These are young stands that are within the prescribed burn blocks. The slash created on the remaining 166 acres would be either lopped and scattered or chipped to reduce breeding sites for the Ips beetle on these sites.

Prescribed Burning (broadcast burning)

Prescribed (broadcast) burning is proposed for an area of 2,857 acres. The objective of this treatment is to reduce fuel loads, re-introduce fire into the disturbance regime, and in some areas to act as a tool for thinning pine seedlings. Stem (TPA) reduction may be completed mechanically if burn windows are unavailable. Vegetation monitoring would be required.

Seed Cut followed by Pre-commercial Thinning and Prescribed Burning

Seed cut harvests are proposed for an area of 2,299 acres. The objective of these harvests is to begin the regeneration process within mature ponderosa pine stands. Mature pine trees would be harvested from these stands but a portion of the best overstory trees would be left to provide seed and shelter for the establishment of natural pine regeneration. Pine would be left at an approximate basal area of 30 square feet per acre. Leave trees would generally be dominant or co-dominant pine with full crowns and good form. Opening up the canopy allows sufficient sunlight to reach the forest floor to establish seedlings, yet provides enough shade to limit the harsh microclimates of full canopy openings. Post harvest activities would include prescribed burning and pre-commercial thinning of any pockets of pole size trees as well as regeneration surveys. Whole tree harvesting is the preferred logging method to reduce fuel loading. Designated skid trails would not be required. Regeneration surveys would be required.

Thinning, Piling and Burning of Natural Fuels

The treatment of natural fuels is proposed for an area of 468 acres within the Spearfish Canyon. The objective of this treatment is to create fuel breaks by removing conifers less than nine inches in diameter and leaving trees at an approximate spacing of 16 feet. Conifers left on site could have the lower limbs removed up to 15 feet above the base of the tree. Woody fuels would then either be piled and burned, or chipped. Fuel breaks within aspen dominated stands would remove all conifers less than 9 inches in diameter. Harvesting would discriminate against spruce to maintain pine structural stage. Pruning of limbs to 15 feet above the base may occur. Fuels may be piled and burned or chipped, depending on site conditions following treatment. Treatments would occur up to 300 feet from currently identified private structures, or as mapped.

2.2.5 Activities Common to All Alternatives

Sanitation Harvest

The purpose and need for this project recognizes that there is a need to alter stand structure within the Project Area to reduce the threat of mountain pine beetle infestation. While there are only small pockets of known beetle activity within the Project Area, 64 percent of the NFS land in the Project Area has an insect risk rating of moderate or high, indicating that forested stands are susceptible to infestation if beetles enter the area. The treatments proposed under Alternatives B and C are intended, in part, to prevent epidemic infestations of mountain pine beetles. However, given that there are epidemic levels of mountain pine beetle in forested areas adjacent to the Project Area and throughout the forest, there remains the potential for further infestation to occur within the Project Area.

In an effort to be responsive to mountain pine beetle infestations as they occur, sanitation harvest proposals would be prepared for any newly identified pockets of mountain pine beetle infestation within the Project Area that occur in or adjacent to ponderosa pine stands identified as having a medium or high insect risk rating. These proposals will identify site specific treatments intended to limit the spread of beetles. Proposed treatments would likely involve cutting of beetle infested trees and thinning of stands to residual basal areas below 80 square feet. Proposals will be field reviewed by resource specialists prior to implementation to

determine whether any special design criteria are required to protect forest resources and to ensure that the proposals comply with Forest Plan direction.

The intent of the proposed sanitation harvest is to act quickly in areas of mountain pine beetle infestation areas. Infested areas would be treated to remove infested trees and beetles in order to maintain beetle population levels below epidemic proportions. If a mountain pine beetle epidemic becomes established in the Project Area, it is anticipated that the scale of management actions required to address the epidemic would go beyond the intent of this sanitation harvest provision. At that point additional NEPA analysis may be required to treat large areas of tree mortality from beetle infestations.

Post-sale Activities

The Knutson-Vandenburg (KV) Act authorizes the Forest Service to collect money from timber sales for resource enhancement, protection, and improvement work in the timber sale area. All proposed KV activities are in addition to the treatments proposed under Alternatives B and C as described above. Actions proposed as KV activities for the West Rim Project Area are listed below:

- **Pre-commercial thinning, release and weed cleaning, and product-other-than-log (POL) thinning:** Thinning of stems 0-9 inch 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, or prescribed fire treatments.
- **Regeneration surveys 3rd and 5th year post-harvest:** Essential KV; Monitoring will determine if mortality rate of trees less than nine inches dbh is less than 75 percent after prescribed burning. At least one survey must be conducted post-burn. Would be conducted following overstory removal and 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.
- **Noxious weed treatment and monitoring:** Spray and monitor noxious weeds following all ground disturbing activities.

- **Road closure:** In general, all newly constructed roads would be closed following timber harvest. Closure methods would be determined at the time of closure depending on site conditions. Possible methods include: locked gates, boulders, dirt berms, downed trees, fences, and partial obliteration and recontouring. Specific road closure decisions would be made in the Travel Management Plan that is currently underway.

2.3 Alternatives Considered but Eliminated from Detailed Analysis

In addition to the two action alternatives, the ID team considered several potential alternatives raised by scoping comments. A brief description of each of these alternatives and the rationale for not carrying them forward for detailed analysis follows:

2.3.1 Mountain Pine Beetle Infestation Near Cheyenne Crossing

Two separate commenters raised the issue of an ongoing mountain pine beetle infestation in the vicinity of Cheyenne Crossing and requested that the Forest Service focus treatments in this area in an attempt to stop or slow the infestation.

The IDT determined that the infestation was for the most part located outside of the West Rim Project Area. It was also determined that due to the rough terrain in the area of the West Rim portion of the infestation the only access would be to construct a new road outside of the Project Area. Because of these factors, it was decided that this issue is best addressed under a separate Categorical Exclusion (CE) that focuses specifically on treating the infested area.

2.3.2 Decommissioning of the Maximum Amount of Roads

One commenter requested an alternative that would decommission as many miles of roads as possible within the Project Area.

The IDT determined that this alternative would be outside the scope of the West Rim project. The Black Hills National Forest is currently in the process of revising its Travel Management Plan, which will identify what routes are necessary and what uses will be allowed on them. The Travel Management Plan would supersede any decisions made at the project level.

2.3.3 No Harvest of Structural Stage 4B or 4C Stands

One commenter requested that the Forest Service defer harvest of all stands that are in structural stages 4B or 4C.

The IDT determined that deferral of these stands would not allow the West Rim project to meet its purpose and need or Forest Plan direction. The stated purpose and need of the project is to reduce fire hazard, reduce mountain pine beetle risk and increase structural stage diversity. Currently, a majority of the stands in the

Project Area are in structural stage 4B or 4C, which is contributing to the high fire hazard and risk of pine beetle infestation across the Project Area. These stands would be thinned to reduce these hazards. Also, the Forest Plan sets Forest-wide objectives for achieving structural stage distributions in certain Management Areas (MA), including MAs 4.1, 5.1 and 5.4 in the West Rim Project Area. There is currently an overabundance of stands in these MAs that are in structural stage 4B or 4C. Alternative A (No Action) presents an alternative to the Proposed Action that does not harvest stands in structural stages 4B or 4C.

2.3.4 Fragmentation Concerns

One commenter requested an alternative that would address fragmentation concerns on the Black Hills National Forest.

The IDT determined that fragmentation is best addressed at the Forest level and is outside the scope of the West Rim project. Different species of wildlife can tolerate, and prefer, different levels of fragmentation. Anecdotal evidence (photos from the Custer expedition) suggests that the Black Hills today may be less fragmented than it was prior to Euro-American settlement.

2.3.5 No Overstory Removal

One commenter requested an alternative that would not include any overstory removal treatments to retain large diameter trees that are more fire resistant.

The IDT determined that not conducting overstory removal treatments would limit the Forest Service's ability to achieve the purpose and need. Overstory removal is an accepted and widely used even-aged treatment method in ponderosa pine ecosystems. Retention of large trees is built in to the structural stage objectives for MAs 4.1, 5.1 and 5.4. Alternative A (No Action) presents an alternative to the Proposed Action that does not include overstory removal.

2.3.6 No Harvesting of Trees Greater than 10" DBH

One commenter requested an alternative that would not harvest any trees that are larger than 10" dbh.

The IDT determined that the project would not meet the purpose and need or Forest Plan direction under this alternative. Deferring all trees greater than 10 inches dbh from harvest would effectively eliminate any commercial harvest and severely limit the Forest Service's ability to reduce fire hazard, reduce beetle risk or improve structural diversity. Alternative A (No Action) presents an alternative to the Proposed Action that does not include timber harvest.

2.3.7 Re-designation of MA 5.1 to MA 4.1

One commenter requested an alternative that would re-designate all areas of MA 5.1 (Resource Production Emphasis) in the Project Area to MA 4.1 (Limited Motorized Use and Forest Product Emphasis).

The IDT determined that widespread re-designation of MAs was outside the scope of the West Rim project. MA designations can be redefined at the project level with a Forest Plan Amendment, but only if the IDT

team determines that the current designation is inappropriate. There is no evidence presented to suggest that the MA 5.1 designation is inappropriate in the West Rim Project Area.

2.3.8 Designation of Structural Stage 4C Stands as MA 3.7

One commenter requested an alternative that would designate all stands of structural stage 4C as MA 3.7.

The IDT determined that this alternative would not achieve the project's purpose and need. MAs 4.1, 5.1 and 5.4 currently contain an overabundance of SS 4C, as defined by Forest-wide MA structural stage objectives. Re-designation of SS 4C stands to MA 3.7 would limit the Forest's ability to work toward the structural stage objectives. In addition, MAs were designated spatially to allow for multiple-use management of the Forest. Re-designation of specific stands across the Project Area would fragment the current MAs, making management of scattered fragments of land more difficult.

2.3.9 Road Decommissioning and Closure Only, No Timber Harvest

One commenter requested an alternative that proposes only road decommissioning or closure and does not include any timber harvest.

The IDT determined that the purpose and need would not be met under this alternative. Timber harvest, both commercial and non-commercial, is a necessary tool to reduce fire hazard, reduce pine beetle risk and improve structural diversity. Decommissioning or closing roads is outside the scope of the West Rim project and will be decided by the ongoing Forest-wide Travel Management Plan revision. Alternative A (No Action) presents an alternative to the Proposed Action that does not include timber harvest.

2.3.10 No New Permanent Roads

One commenter on the Draft EIS requested an alternative that would propose no new permanent roads within the Project Area. The intent would be to minimize the impacts of roads on riparian areas and sediment production to streams.

The IDT reviewed this alternative and determined that road density increases are limited in Class III watersheds (see DEIS page 210) and that any potential increased sediment would not have an impact on water quality. Impacts on riparian ecosystems (DEIS page 218) would be minimal. Therefore, the IDT determined that the intent of this alternative has been addressed through the design of the Proposed Action and Alternative C. In addition, the Black Hills National Forest is currently in the process of revising its Travel Management Plan, which will identify what routes are necessary and what roads should be closed or decommissioned. The Travel Management Plan would supersede any decisions made at the project level.

2.4 Comparison of Alternatives

A comparison of the alternatives by how they address the key issues, respond to the purpose and need, and the environmental effects on selected components is provided for the public and decision maker. The alternatives are compared in Table 9 by specific measurement indicators developed for each issue and purpose and need elements and in Table 10 by effects on selected environmental component. A complete analysis of the effects of the alternatives by resource topic is provided in Chapter 3.

Table 9. Comparison of Alternatives by Issues and Purpose and Need Elements

	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Forest Plan Objectives
Issue and Purpose and Need Element – Fuel Reduction in Spearfish Canyon				
Indicator – Fire hazard in WUI				
High to Very High Fire Hazard Category	85%	65%	65%	25 to 50%
Low to Moderate Fire Hazard Category	15%	35%	35%	50 to 70%
Indicator – Level of Vegetation Management (acres treated)	0	17,363	18,291	NA
Indicator – Prescribed Burning (acres)	0	13,226	14,154	NA
Purpose and Need Element - Risk of Mountain Pine Beetle Infestation				
Indicator – Mountain Pine Beetle Risk Rating				
Percentage in High Mountain Pine Beetle Risk	65%	35%	35%	
Percentage in Moderate Mountain Pine Beetle Risk	16%	42%	42%	
Percentage in Low Mountain Pine Beetle Risk	19%	23%	23%	
Purpose and Need Element - Increase in Structural Diversity in Ponderosa Pine Stands				
Indicator – Movement in Structural Stages toward Forest Plan Objectives				
Percentage in Grass-forb	1%	1%	1%	5%
Percentage in Shrub-seedling	3%	3%	3%	5%
Percentage in Sapling-pole; <40% crown cover	2%	5%	5%	10%
Percentage in Sapling-pole; 40-70% crown cover	0%	11%	11%	15%
Percentage in Sapling-pole; >70% crown cover	2%	1%	1%	5%
Percentage in Mature; <40% crown cover	16%	47%	47%	25%
Percentage in Mature; 40-70% crown cover	55%	23%	23%	25%
Percentage in Mature; >70% crown cover	19%	7%	7%	5%
Late Successional	2%	2%	2%	5%

Table 10. Comparison of Alternatives on Environmental Effects to Selected Resources[1]

	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C
Effects on Cooper's Mountain Snail	No change	May adversely impact individuals but is not likely to result in the loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability.	May adversely impact individuals but is not likely to result in the loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability. This alternative would have additional impacts to snails compared to Alternative B.
Effects on American Dipper	No change	Dippers are not likely to be impacted by the proposed fuels treatments in Spearfish Canyon under Alternative B	Short-term impacts from additional fuels treatments in Spearfish Canyon would have additional impacts compared to Alternative B.
Effects on Road density (mi/sq mi)			
Lower Spearfish Creek	3.0	3.2	3.2
Cleopatra Creek	2.8	3.2	3.2
Iron Creek	3.8	4.3	4.3
Annie Creek	3.4	3.8	3.8
Middle Spearfish Creek	3.4	3.6	3.6
Dead Ox Creek	3.9	4.6	4.6
Upper Spearfish Creek	4.0	4.4	4.4
New roads constructed	0.0	35.0	35.0
Timber Volume (Million bd ft)	0	59	59

[1] increased road density in the Condition Class III watersheds (Lower Spearfish Creek, Cleopatra Creek and Iron Creek) is a concern with regard to the Forest's direction for Condition Class III watersheds.

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Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction

This section describes the affected environment and discloses potential effects of the proposed action and each alternative. It forms the scientific and analytical basis for the comparison of the potential environmental effects of the alternatives. In determining potential environmental consequences of each alternative, the 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, the Phase II Amendment FEIS, the Phase II Amendment ROD, and the Phase II Amendment Biological Assessment/Biological Evaluation 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 existing 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. These past activities helped shape the condition that are present today and are reflected in the existing conditions descriptions for each resource.

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 fuel management projects currently underway (see *Section 3.2.2 Ongoing Activities*).

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

Water developments and limited timber harvest have occurred on private lands. Site-specific data are not available.

Roads and Travel Management

The Project Area contains approximately 213 miles of roads on NFS land and approximately 200 miles of roads on private land. Additionally, there are approximately 45 miles of designated non-motorized trails including trails in the Eagle Cliff, Big Hill and Old Baldy systems; and approximately seven miles of designated snowmobile trails.

Timber Harvest

Some of the NFS lands in the Project Area have had vegetative treatments over the last 20 years. Commercial harvests and non-commercial timber stand improvement treatments have taken place since the late 1970's.

There have been nine active timber sales in recent years (Table 11). These sales harvested a total of 5,114 acres in the Project Area.

Table 11. Past Timber Sales within the West Rim Project Area.

Timber Sale	Acres
Hanna	37
Hellox	60
Hellsgate	1244
Keough	185
Maurice	6
Park	1830
Pond	467
Rimrock	726
Tollgate	559
Total	5114

3.2.2 Ongoing Activities

A variety of activities are ongoing in the Project Area. Timber harvest is not known to be taking place on other ownerships. 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 for domestic water supply. Development of private land is extensive for private residences in Spearfish Canyon, but relatively minimal on other parts of the Project Area. The extent of each type of ongoing activity is listed below.

Fuel Treatment

There are several fuel reduction projects that are active in and adjacent to the West Rim Project Area. These include:

- **Griggs Fuel Management CE** – the plan authorizes 43 acres of mulching, 1,170 acres of thinning, 500 acres of prescribed fire, and 326 acres of fuel break construction. Most of the project is located immediately west of West Rim in the Citadel Project Area. The Griggs area borders West Rim to the northwest, near the Aspen Hills and Mountain Plains subdivisions.
- **Spearfish Canyon 1 CE** – authorizes two fuel breaks, one near the mouth of Spearfish Canyon and the other near Savoy. The fuel breaks are approximately 300 feet wide; the one near the mouth is approximately 0.5 miles long while the one near Savoy is 1 mile long. This project is ongoing.

- **Spearfish Canyon 2 CE** – authorizes fuel breaks along private land adjacent to Highway 14A between Savoy and Cheyenne Crossing. Buffers east of the highway are 200-300 feet; west of the highway are 100 feet. This project is ongoing.

Grazing

Grazing occurs in the Project Area on a permit basis. Grazing is not currently permitted in Spearfish Canyon.

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 within the Project Area. Residential development is occurring at a high rate in Spearfish Canyon and in the area surrounding Spearfish, South Dakota, immediately to the north.

Recreation

Because of its proximity to Spearfish, South Dakota, and the presence of Spearfish Canyon, 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.

Special Use Permits

Several activities take place under special use permit within the Project Area. These activities include communications towers, electricity lines, waterlines, one cabin and National Guard training.

Timber Harvest

There have been nine active timber sales in recent years (Table 11). The only sale that is currently active is the Hanna Timber Sale, which will affect only 37 acres in the Project Area.

3.2.3 Reasonably Foreseeable Future Activities

Reasonably foreseeable future actions in the Project Area include fire suppression, fuel treatment, vegetation management, treatment of noxious weeds, 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

Grazing will continue in the Project Area on a permit basis, except for Spearfish Canyon.

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 or trends are anticipated.

Recreation

Future recreational use is expected to be similar to current uses. Potential effects of the ongoing Black Hills National Forest travel management planning effort (expected to be completed in 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 Forest Resources

This section describes the Project Area's vegetation from a silvicultural perspective and provides a discussion of the environmental consequences of implementing the alternatives to the forest resources. More detailed information can be found in the West Rim Project Silviculture Resource Report (JW Associates 2008a), located in the project file.

3.3.1 Existing Conditions for Forest Resources

The following section describes the existing vegetation within the Project Area in terms of vegetative diversity, timber production, and risks to insect and disease.

Vegetative Diversity

The vegetation of the Project Area is dominated by ponderosa pine forest (Figure 2) that comprises 80 percent of the NFS land. This is similar to the surrounding ecosystem, as ponderosa pine is also the most common cover type on the Black Hills National Forest. Approximately nine percent of the Project Area is dominated by white spruce. There is also one small area (30 acres) of Douglas fir (classified as "other" in Figure 2).

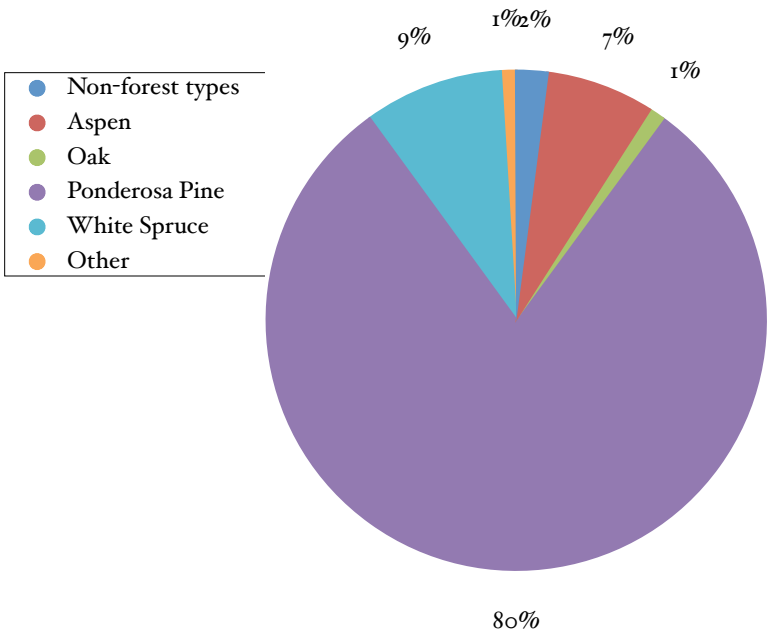

Figure 2. Existing Vegetation Cover Types for National Forest Lands within the Project Area.

Approximately eight percent of the Project Area is dominated by hardwood forests, which are primarily aspen stands. Quaking aspen covers seven percent of the Project Area and bur oak covers one percent. There is a small amount of paper birch, which is included in "other" cover types in Figure 2. Two percent of the area is considered "nonforested" and includes grass-dominated meadows, shrublands, rock and water.

Forest Successional Stages

Habitat structural stage describes the successional stage of forest stands based on tree size and crown cover. In order to provide biologically diverse ecosystems, the Forest Plan identifies distribution objectives for some Management Areas (MAs) where structural stage could be altered through timber harvest and other types of vegetation management.

There are four MA designations that cover 80 percent of the NFS lands in the Project Area. Table 12 displays the proportion of these areas in the Project Area.

Table 12. West Rim Management Areas with Commerical Timber Harvest

Management Area	Emphasis	Area in Project Area
4.1	Limited Motorized Use and Forest Products	3,006 acres
5.1	Resource Production	16,168 acres
5.4	Big Game Winter Range	1,213 acres
5.6	Forest Products, Recreation and Big Game	7,185 acres

All the MAs listed in Table 12 have the same structural stage distribution objective for ponderosa pine forests (USDA-Forest Service 2006a). This objective is to be met across the forest and therefore a goal for each MA is to move towards this distribution so that the entire Forest moves in that direction. Figure 3 provides a comparison between the structural stage distributions for the four MAs presented above compared to the objective to assess how close the existing condition compares this objective or desired condition. This information was further used to estimate the potential effects of the proposed treatments on the structural stage distribution of ponderosa pine.

A field assessment of late successional habitat in the Project Area was completed that identified 757 acres of previously designated mature habitat as late successional. That additional area of SS5 (Table 13) includes both ponderosa and white spruce stands in 757 acres that were previously recorded as mature (structural stages 4C, 4B and 4A). The total amount of ponderosa pine SS5 is also shown in Table 13. The late successional habitats identified are located in all MAs, except MA 5.4, within the Project Area.

Table 13. West Rim Structural Stage 5 by Management Area[1]

Management Area	Additional Area of SS 5 Identified in Field Assessment[1]	Total Area of Ponderosa Pine SS5
4.1	83 acres	97 acres
4.2A	124 acres	0 acres
5.1	418 acres	386 acres
5.4	0 acres	0 acres
5.6	132 acres	132 acres
Total	757 acres	615 acres

[1] The additional area in Structural Stage 5 identified in field assessments includes both ponderosa pine and white spruce.

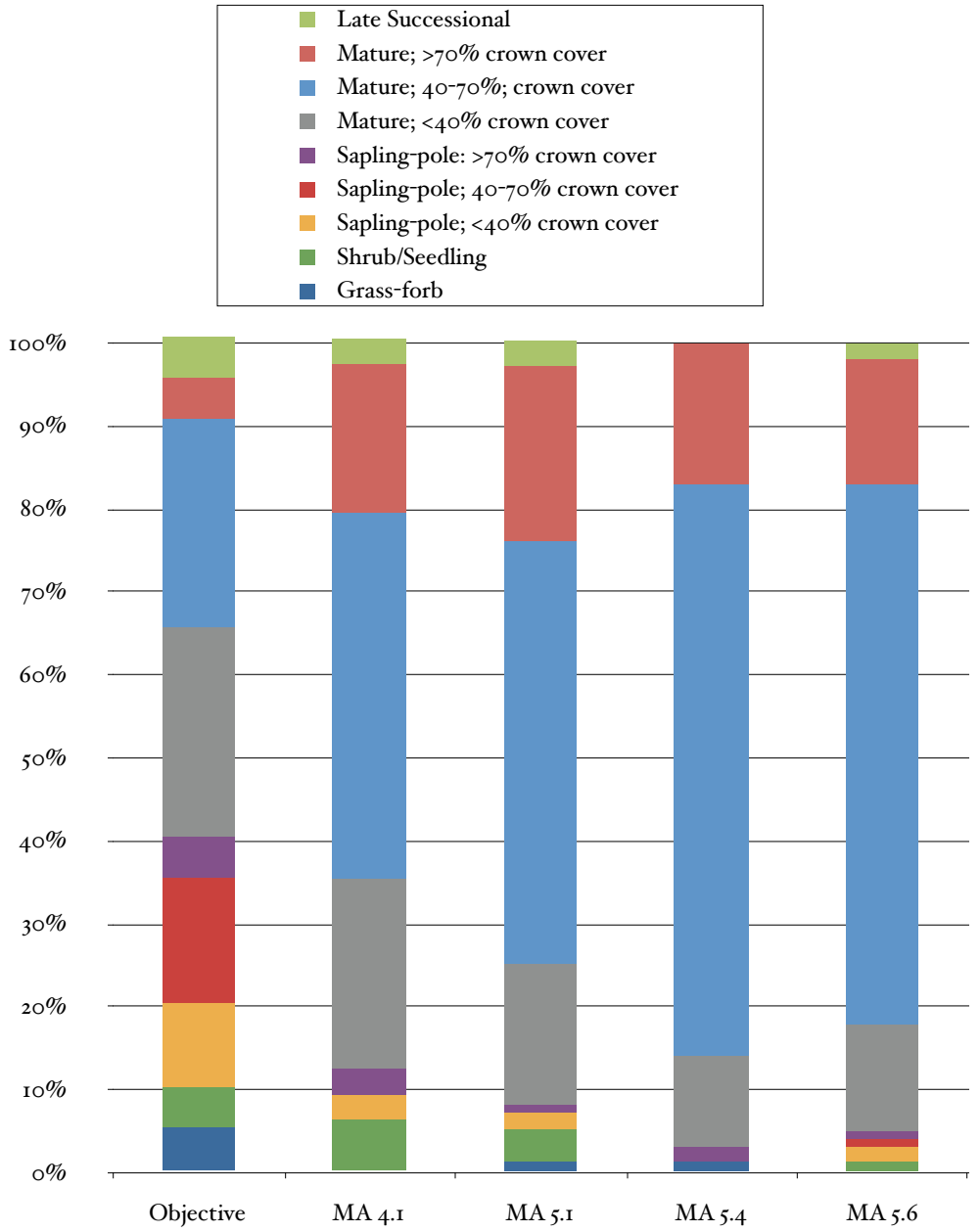

Figure 3. Comparison of Project Area Structural Stage Distributions by Management Area to Forest-wide Objectives[1,2]

1 The pine stands within the Spearfish Canyon MA (4.2A) are not included in this analysis since there is no structural stage distribution objective for the Canyon. Data is from 2006 Forest Monitoring Report (USDA-Forest Service 2007d)
2 The data in this figure includes the additional areas of late successional habitat documented during a field assessment completed after the 2006 Forest Monitoring Report (USDA-Forest Service 2007d).

MA 4.1 Structural Stages

In the Project Area, there are 3,006 acres of ponderosa pine forest within MA 4.1. The distribution of MA 4.1 structural stages across the forest is similar to the Project Area with a majority of the stands in mature structural stages (Figure 3). In the Project Area, approximately 85 percent of the MA 4.1 stands are mature. The Project Area does have a slightly higher proportion of late successional stands and a very small amount of grass/forb (less than one percent) compared to forest-wide distribution. To meet Forest Plan objectives for MA 4.1, the amount of area in the younger structural stages (sapling-pole) needs to increase, and the amount of late mature stands with greater than 40 percent canopy cover needs to decrease. There still needs to be an increase in late successional stage stands to meet Forest Plan objectives, even after accounting for the updated 2006 forest-wide data. After including the 2006 data, MA 4.1 has just three percent of its area in late successional ponderosa pine.

MA 5.1 Structural Stages

There are 16,168 acres of ponderosa pine forest within MA 5.1 in the Project Area. Like the MA 4.1 distribution, the distribution of MA 5.1 structural stages across the forest is similar to the Project Area with a majority of the stands in mature structural stages (89 percent of MA 5.1 in the Project Area). Also similar to the forest-wide distribution, there is a lack of sapling-pole stands. The Project Area has a slightly higher proportion of late successional stands and a very small amount of grass/forb (less than one percent) compared to the forest-wide distribution. Recent wildfires have burned in MA 5.1 areas outside of the Project Area, creating new areas of grass/forb successional stages (USDA-Forest Service 2007a). Compared to the forest-wide distribution, the Project Area has a very small amount of grass/forb successional stage (USDA-Forest Service 2007a).

In order to meet Forest Plan objectives for MA 5.1, the Project Area need move areas in the sapling-pole structural stages. There also needs to be a corresponding reduction in mature stands with greater than 40 percent canopy cover. Because of the abundance of grass/forb in MA 5.1 outside of the Project Area, it is not necessary to increase the amount of grass/forb in this area, despite not currently meeting the five percent objective of the Forest Plan. Similar to MA 4.1, this MA does not currently meet the objective of five percent of the area in a late successional stage, with two percent in that category.

MA 5.4 Structural Stages

There are 1,213 acres of ponderosa pine forest within MA 5.4 in the Project Area, which represents less than one percent of the MA 5.4 ponderosa pine stands found across the Forest. Because of its small size, the structural stage distribution of MA 5.4 (Figure 3), or changes in this distribution, has little impact on the forest-wide distribution. At 97 percent, this MA has the highest proportion of mature ponderosa stands of the Project Area MAs. The area is nearly completely dominated by mature stands. Only two percent of the area exists as sapling-pole and less than one percent is late successional stage ponderosa. Forest-Wide, 15 percent of the MA 5.4 area is in the grass/forb stage and less than one percent is in late successional habitat. Recent wildfires have contributed to the amount of grass/forb stages across the forest (USDA-Forest Service 2007a). Because these fires missed the West Rim Project Area, this area did not see a corresponding increase in grass/forb, and only one percent of the area is in this structural stage. This MA does not provide any late

successional structural stage stands. To move this area closer to Forest Plan objectives, there would need to be a large increase in sapling-pole area, a decrease in mature pine with greater than 40 percent canopy cover and an increase in late successional ponderosa pine.

MA 5.6 Structural Stages

There are 7,185 acres of ponderosa pine forest in the Project Area's MA 5.6. Across the forest, 90 percent of the ponderosa pine in MA 5.6 are in a mature structural stage. This is reflected in the West Rim Project Area, with 93 percent of the ponderosa pine in this MA existing as mature stands. In the Project Area, less than one percent is in the shrub/seedling stage and only four percent exists as sapling-pole (Figure 3). Like other areas, there needs to be a reduction in mature stands with greater than 40 percent canopy cover and an increase in shrub/seedling and sapling-pole structural stages to meet Forest Plan objectives. This MA does not currently meet the objective of five percent of the area in a late successional stage ponderosa pine stands. Even with the inclusion of the most recent 2006 survey data, this MA still only provides two percent of the Project Area as late successional stands.

Timber Production

There are about 26,000 acres of ponderosa pine forest that are suitable and available for timber management within the Project Area. These are lands that are suitable for growing timber and are within a management designation that includes managing the forest stands for long-term timber production.

Figure 4 displays the age class distribution for suitable pine stands within the Project Area. Most of the suitable pine stands are between 80 and 140 years of age and more than half of the area is covered by stands over 100 years of age (Figure 4). There is relatively little area of suitable pine between 20 and 79 years of age. A more balanced distribution of age classes would favor a sustainable future flow of timber.

Timber growth

Forest stand stocking levels are a measure of the number of trees in a stand compared to the desired number of trees determined to be best for growth or meeting other forest management objectives. Because of limited site resources, suppressed trees in an "overstocked" stand grow slower and some may die. Stands that are "understocked" do not have enough trees to fully occupy the site and are not growing as many trees as the site could support. Appendix H of the Forest Plan contains tree stocking guides for pine stands on the Black Hills National Forest (USDA-Forest Service 2006a). These tree guides are for optimizing timber production, providing thermal cover, and for reducing mountain pine beetle risk. Lower stocking levels are recommended for minimizing mountain pine beetle risk (less than 80 sq. ft./acre) and higher stocking levels (over 150 sq. ft./acre) are recommended for providing thermal cover for wildlife.

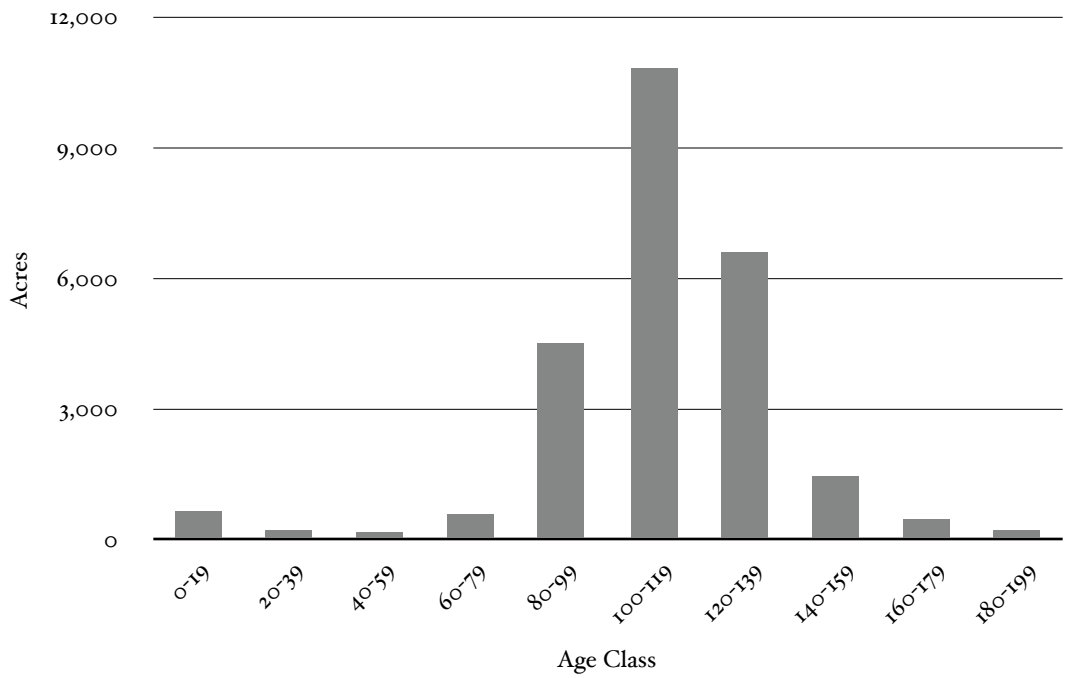

Figure 4. Age Class Distribution of Suitable Pine in the West Rim Project Area

Most (60 percent) of the suitable pine stands in the Project Area have between 80 and 150 square feet of basal area per acre. Eighteen percent have less than 80 square feet per acre and 22 percent have more than 150 square feet per acre. These numbers provide a general view of stand stocking levels for the area, an analysis of more stand attributes, such as stand age and range of tree diameters, is necessary for determining the specific stocking level recommended for each stand. Each suitable stand in the Project Area was analyzed to determine recommendations for treatments, as reflected in the proposed action. These recommended treatments are based on stand conditions and the management goals and objectives for the area.

Forest Insects and Disease

There are a number of forest insects and diseases that are endemic to the forests of the Black Hills and that have been observed in the Project Area or in adjacent areas (Stiller 2007). These include western gall rust (*Peridermium harknessii*), armillaria root disease (*Armillaria ostoyae*), red rot disease (*Dichomitus squalens*), Diplodia tip blight (*Sphaeropsis sapinea*), ips beetle (*Ips pini)*, and mountain pine beetle (*Dendroctonus ponderosae*). While there may be some localized mortality or increased defects, these pests are not currently causing wide spread mortality. However, an analysis of the forest vegetation in the Project Area indicates that there is a risk of substantial loss if the population of mountain pine beetles were to increase.

Beetle Risk

Mountain pine beetles are native to western ponderosa pine forests and are a natural part of the Black Hills ecosystem. Historically this beetle has killed large numbers of trees within ponderosa pine stands in the Black Hills (USDA-Forest Service 1990). Large infestations of mountain pine beetles 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 widespread across the Black Hills National Forest with epidemic populations near Sturgis in the Northern Hills, and near Deerfield Lake and Custer in the Central Hills.

A mountain pine beetle risk rating has been developed to gauge relative losses that could occur in an infested stand. In the Project Area, 65 percent of the National Forest Lands have a high risk rating; 16 percent has a medium risk rating; 19 percent has a low risk rating (Figure 5). This analysis includes all cover types, not just ponderosa pine, so the area within the low risk category includes areas such as meadows and hardwood stands that have no risk. Therefore, the percentage of ponderosa stands at high or medium risk is higher than indicated.

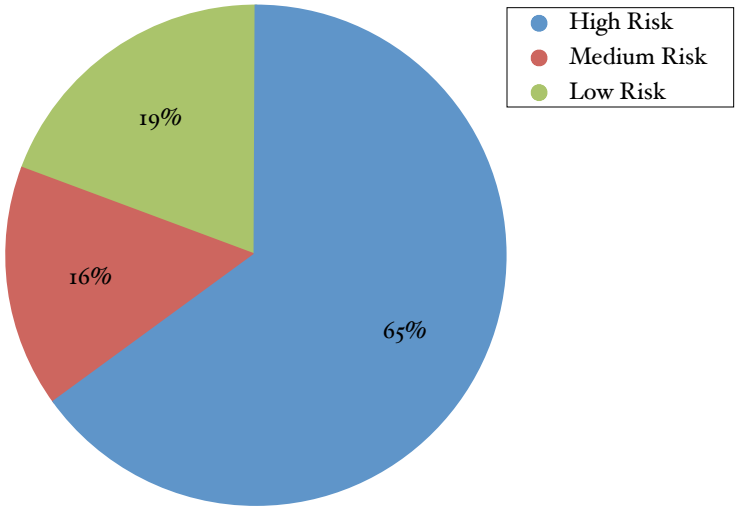

Figure 5. Mountain Pine Beetle Risk Rating of National Forest Land within the West Rim Project Area.

3.3.2 Environmental Consequences for Forest Resources

The environmental consequences analysis concentrates on the effects of the alternatives on vegetative diversity, timber production and risks of mountain pine beetle infestation. Effects on vegetative diversity are measured by evaluating changes in vegetation species composition (cover types) and forest successional stages (structural stages) following the proposed treatments. Effects on timber production are assessed by comparing the amounts of timber volume harvested as well as possible effects on the long-term timber yields and growth of the suitable ponderosa pine stands. The risk of mountain pine beetle infestation is analyzed by assessing the change in area within each risk level.

Alternative A (No Action) - Direct and Indirect Effects

Vegetative Diversity

Alternative A would have no direct effect on the species composition of the Project Area. Over time, without any natural disturbance such as wildfires or insect epidemics, the amount of area dominated by ponderosa pine

and spruce would be expected to increase as these species continue to encroach into existing meadows and hardwood stands. The area of open meadows and predominately hardwood stands would diminish as conifers invade openings and continue to regenerate within aspen, oak and birch stands. In addition, as the conifer stands grow and develop, the forest canopy would shade out many of the understory plants, possibly reducing the variety of plant species found within these stands.

Currently, the ponderosa pine cover type occupies 80 percent of the NFS land in the Project Area. For this alternative, without any large natural disturbances, the proportion of ponderosa pine cover types would be expected to rise over time, and the diversity of vegetation would be reduced.

Forest Successional Stages

Similar to vegetation species composition, Alternative A would not directly affect forest successional stages in the Project Area. In the absence of natural disturbances, early successional habitats would continue to decline as pine stands continue to progress toward later successional stages.

A majority of the ponderosa pine stands in the Project Area are in the mature structural stage (Table 14). Without harvest or natural disturbances, some of these stands would progress into the older and denser structural stages. Currently, late successional habitat (Structural Stage 5) is below management objectives both within the Project Area and forest-wide (Table 15). Over the next ten to twenty years some of the mature stands could develop into late successional habitats. However, even fewer stands would be found in the earlier successional stages. This alternative would not provide a variety of successional stages, which is an objective stated within the Forest Plan. A forest that is predominantly mature and late successional may be more vulnerable to large scale natural disturbances such as wildfires and insect epidemics.

Timber Production

Alternative A does not propose timber harvest within the Project Area and, therefore, would not provide commercial wood products to the local economy. Deferring harvest would increase the standing timber volume as the existing trees grow. However, the risk of loss of some timber volume due to wildfire, insects or disease would also be expected to increase as stands mature and become more susceptible to these disturbances.

Alternative A would have no direct effect on the stocking levels and growth rates of the pine stands in the Project Area. Because no commercial or non-commercial thinning would occur, stands would continue to grow at current rates. However, as the pine stands grow, stand densities would continue to increase, increasing the stand's susceptibility to insects and disease. The rate of volume growth may slow at an earlier age than expected if a stand is infected by insects or disease. Currently 82 percent of the area of suitable pine has an average basal area above the 80 square feet per acre stocking level recommendation for minimizing mountain pine beetle infestation. Therefore, an indirect effect of Alternative A is that it is likely that more of the area would be above recommended stocking levels in the future, resulting in lower growth rates and potentially increased losses due to insect and disease.

Table 14. West Rim Project Area Structural Stage Distribution for each Alternative by Management Area[1]

		MA 4.1		MA 5.1		MA 5.4		MA 5.6	
Habitat Structural Stage (SS)	Desired Forest Wide	Alt. A	Alts.B & C	Alt. A	Alts.B & C	Alt. A	Alts.B & C	Alt. A	Alts.B & C
SS1 - Grass-forb	5	<1	<1	1	1	1	15	<1	<1
SS2 - Shrub-seedling	5	6	6	4	4	0	0	<1	<1
SS3A - Sapling-pole; <40% crown cover	10	3	8	2	5	0	4	2	4
SS3B - Sapling-pole; 40-70% crown cover	15	<1	16	<1	11	0	4	1	9
SS3C - Sapling-pole; >70% crown cover	5	3	0	1	1	2	2	1	1
SS 4A - Mature; <40% crown cover	25	23	58	17	49	11	10	13	43
SS4B - Mature; 40-70% crown cover	25	44	3	51	20	69	52	65	35
SS4C - Mature; >70% crown cover	5	18	5	21	7	17	13	15	6
SS5 - Late Successional	5	3	3	2	2	0	0	2	2

[1] The table shows the percentage within each MA.

Table 15. Forest-wide Structural Stage Distribution for each Alternative by Management Area[1]

		MA 4.1		MA 5.1		MA 5.4		MA 5.6	
Habitat Structural Stage (SS)	Desired Forest Wide	Alt. A	Alts.B & C	Alt. A	Alts.B & C	Alt. A	Alts.B & C	Alt. A	Alts.B & C
SS1 - Grass-forb	5	1	1	8	8	15	15	1	1
SS2 - Shrub-seedling	5	1	1	3	3	3	3	5	5
SS3A - Sapling-pole; <40% crown cover	10	2	2	4	4	5	5	3	3
SS3B - Sapling-pole; 40-70% crown cover	15	4	5	4	5	7	7	1	4
SS3C - Sapling-pole; >70% crown cover	5	3	3	2	2	5	5	1	1
SS 4A - Mature; <40% crown cover	25	24	27	38	39	25	25	29	39
SS4B - Mature; 40-70% crown cover	25	39	36	30	29	26	26	45	34
SS4C - Mature; >70% crown cover	5	25	24	10	10	14	14	13	10
SS5 - Late Successional	5	1	1	<1	<1	<1	<1	3	3

Mountain Pine Beetle Risk

Most (65 percent) of the NFS lands within the Project Area have a high risk rating for mountain pine beetle (Figure 5). Alternative A would not change these conditions in the short term. However, as the ponderosa pine stands increase in density, more of the stands would be expected to develop higher risk characteristics. Some of the stands that are currently rated as medium risk would develop into high risk stands unless affected by natural disturbances such as wind or fire. If the population of mountain pine beetles were to increase in the area, high rates of tree mortality would be expected within these high risk stands.

Alternative A (No Action) - Cumulative Effects

This section presents the potential cumulative effects of the past, present and future foreseeable actions in and adjacent to the Project Area on the composition and condition of the forest vegetation within the Project Area. The cumulative effects analysis covers a period of time starting with settlement of the area by Europeans

[1] The table shows the percentage within each MA.

up through the five to ten years into the future. The cumulative effects analysis area includes the West Rim Project Area as well as NFS lands adjacent to the West Rim Project Area where on-going or foreseeable future vegetation management projects could have an effect on the spread of mountain pine beetles or wildfire into the area.

The existing condition of the vegetation within the Project Area is the result of the past and present human activities within the area. The Euro-American settlement of the Black Hills area in the late 1800's brought with it mining, logging, road construction, grazing, non-native plant and animal species, human-caused fires, suppression of natural fires, and many other activities that affected the vegetation of the area. All of these activities have altered the natural disturbance regimes of the forest. Possibly one of the greatest impacts that human settlement has had on the vegetation is widespread fire suppression. In some areas the current fire free interval is more than twice as long as the longest pre-settlement interval (Brown and Sieg 1996). The density of the ponderosa pine forest has increased and pine has encroached upon many areas that were once open meadow areas or hardwood stands. The policy of suppressing wildfires has resulted in many forests developing denser understory vegetation that would have historically been reduced by frequent, low-intensity fires.

More recent timber harvesting and timber stand improvement projects have reduced the density of many of the stands. Harvesting has also created a few areas of younger conifer stands, although intermediate rather than regeneration harvests have been the most common treatments in the past. There have been nine active timber sales in recent years (Table 11). These sales harvested a total of 5,114 acres in the Project Area. The effects of most of these sales are reflected in the existing vegetative conditions displayed above. The only sale that is currently active is the Hanna Timber Sale, which will affect only 37 acres in the Project Area.

The effect of these past and on-going vegetation treatments has been an increase in the merchantable volume growth rates, an increase in the quality of timber and a minimal amount of insect and disease infestations within the Project Area. However, not all areas with dense stand conditions were treated in the past and others have since become overstocked. Although much of the forested area has been actively managed in the past, there are many overstocked mature stands in the area today. This is the result of growth and time. Forest stands are dynamic and without disturbance, whether natural or human induced, forests will increase in density and age.

The Project Area includes an area of over 10,000 acres of privately owned lands. Much of this land was mined in the past. There has been limited timber harvesting on privately owned lands in recent years and it is expected that there will be a limited amount in the future. Since private land comprises 19 percent of the Project Area and much of it is timberland, the effects of timber harvesting on these lands could have an effect on the composition and structure of the forest vegetation of the area. Some of the privately held lands are being subdivided and new, single family residences are being built. This change in land use will reduce the amount of forested area as well as the probability of commercial timber harvests on these lands. However, specific data is not available for these possible future activities on privately owned lands and therefore specific effects cannot be estimated.

The cumulative effect of the past, present and reasonably foreseeable future actions on the condition of the forest vegetation in the Project Area under Alternative A is an area dominated by mature ponderosa pine

stands that are generally healthy but relatively homogenous in age and structure and increasingly at risk to insects and wildfire.

Alternative B (Proposed Action) - Direct and Indirect Effects

Vegetative Diversity

Alternative B proposes a variety of vegetation treatments including thinning pine stands to reduce tree densities; overstory removal, seed cuts and clear cutting to initiate younger structural stages; and meadow and hardwood stand enhancements to increase the amount of these vegetative community types. Prescribed fire and natural fuel treatments would also be used to reduce wildland fuels and reduce wildfire hazard.

Alternative B would slightly alter the pattern of vegetation cover types. Proposed hardwood enhancement treatments would increase the area of aspen by about 528 acres and the area of oak by 85 acres. Additionally, inclusions of aspen within treated pine stands would be enhanced by removing the pine from the perimeter of the inclusions. The preservation and expansion of these aspen inclusions would enhance species diversity within pine dominated stands. Meadow enhancements would create an additional 37 acres of grassland. These activities would reduce the area of pine dominated stands in the Project Area by about two percent, with the total percent of the area dominated by pine dropping from 80 to 78 percent.

This alternative would also increase the diversity of understory plants within many pine stands because of thinning, disturbance caused by logging, pre-commercial thinning, fuel reduction activities, and prescribed fire. A total of 6,991 acres would be thinned (commercial and/or pre-commercial thinning), which would open up treated stands to increased sunlight. Reducing the density would also increase the availability of moisture and nutrients for understory plants including grasses, forbs and shrubs. Inclusions of aspen and oak within these pine stands would also benefit from these treatments. Disturbance created by prescribed fire would help stimulate the regeneration of the less shade tolerant plant species.

Forest Successional Stages

The proposed treatments would shift the structural stage distribution of ponderosa pine stands. The treatments have the following effects:

- **Commercial thinning and seed cuts** - These treatments in mature conifer stands usually reduce the crown cover class and promote the development of multi-layered stands as pine regeneration develops in the understory due to improved seedbed and increased sunlight.
- **Overstory Removal** - Removing the mature overstory trees from an established stand of pine seedlings or saplings shifts these areas to an earlier successional stage. This treatment creates a young even aged stand structure.
- **Pre-commercial thinning** – This treatment lowers the crown cover class for most stands.
- **Clear cutting followed by prescribed burning** - In mature pine stands, this treatment would shift these areas to a very early structural stage dominated by grasses and forbs.

Alternative B would shift the distribution of habitat structural stages. The hardwood and meadow enhancement treatments would reduce the total amount of pine forest by about two percent due to the conversion of these areas to hardwoods and meadows. The area in the mature structural stages with greater than 40 percent crown cover (4C and 4B) would drop in all affected MAs. MAs 4.1, 5.1 and 5.6 would have an increase in the amount of area existing in the mature structural stage with less than 40 percent crown cover. This would be the result of the commercial thinning and seed cut treatments, which reduce the crown cover of some of the mature stands in the area. However, MA 5.4 would have a slight reduction in this structural stage (mature; less than 40 percent cover). This is due to the proposed clearcut harvests, which would convert some of this structural stage to grass/forb, the earliest structural stage (1).

The area of sapling-pole structural stage with less than 70 percent canopy cover (3A and 3B) would increase in all the MAs because of proposed overstory removals. This treatment would remove the mature component from these stands, creating predominantly sapling-pole size stands.

The area of grass and forbs would not change in any of the Management Areas except for MA 5.4. In this MA, grass/forbs would increase because of the proposed clear cut harvests that would return these areas to an early seral stage.

The area of late successional pine forest would only change in MA 5.1. In this MA, overstory removal is proposed within 56 acres of late successional habitat.

In addition to structural stage objectives, the Forest Plan also has objectives for management of areas of large trees. The objective (across all MAs) is to have at least 10 percent of the mature ponderosa pine area with an average tree size of "very large". Meeting this objective requires that the majority of the basal area is in live trees with diameters of 16 inches or greater. Table 16 displays the total area of mature ponderosa pine (structural stage 4) and the area of mature pine with a very large average diameter for all alternatives.

Table 16. Area of Structural Stage 4 within the West Rim Project Area with a Very Large Average Tree Size by Management Area and Alternative.

Management Area	Alternative A (existing condition)			Alternatives B and C		
	Total Mature Stage Pine (acres)	"Very Large" Mature Stage Pine (acres)	% of "Very Large" mature pine	Total Mature Stage Pine (acres)	"Very Large" Mature Stage Pine (acres)	% of "Very Large" mature pine
4.1	2,527	388	15	1,975	258	13
5.1	14,361	2,151	15	11,999	1,727	14
5.4	1,179	202	17	912	167	18
5.6	6,677	1,725	26	5,809	1,469	25
Total	25,244	4,466	18	20,695	3,621	17

All alternatives would meet the large tree objective for ponderosa pine. The reduction in area of large trees in Table 4 are due to existing areas with very large trees being converted to younger structural stages or converted to hardwoods (overstory removals and commercial hardwood enhancement treatments). Not shown in this table are areas that would meet the definition of the "very large" tree objective under Alternatives B and C once treatment is completed. In these areas, commercial thinnings and seed cuts would favor leaving the larger, more dominant trees in these stands while removing the smaller co-dominant and suppressed trees. These removals would shift the average diameter upward in these stands. These treatments would also help to grow larger trees faster in the future by concentrating growth on fewer larger trees.

Implementation of Alternative B would shift the area towards the desired structural stage distribution in all MAs, even though none of the MAs would meet the objectives following treatment. Vegetative treatments may span decades to create the vegetative changes necessary for one structural stage to develop into another structural stage (USDA-Forest 2007a). Forest stands are dynamic and change with time, and therefore, the distribution of structural stages also changes with time. Because of this, obtaining of the desired distribution is a long-term process and may involve several decades of management.

In general, the treatments proposed under Alternative B would help to achieve the desired distribution of structural stages in the long-term. This alternative would reduce the amount of area in the mature structural stages and increase the amount of area within the sapling-pole stages. It would not directly increase late successional pine forest and would reduce that structural stage by 56 acres in MA 5.1. However, mature stands that are retained could develop into late successional habitat over time. The earliest successional stage, grass-forb, would be increased only in MA 5.4. This MA already has more area in this stage than desired forest-wide. However, the Project Area contains less than one percent of the pine in this MA. This increase in the grass-forb structural stage would have a negligible effect on the forest-wide proportion of grass-forbs. In addition, this stage can transition into successional stage 2 (shrub/seedling) over a relatively short period of time (often within 10 years).

Structural stages are managed in the Project Area to achieve the Forest-wide goals for structural stage distribution. Alternative B would move all structural stages toward their Forest-wide goals except for SS4A (Table 15). The increase in SS4A is a result of the treatments in SS4B and SS4C that opened up the canopy to reduce the fire hazard in those stands. These treatments also achieve the Forest Plan objective 10-01 to manage for 50-75 percent moderate-to-low fire hazard in the WUI and reduce fire hazard within the proximity of structures (FP I-35).

Timber Production

Alternative B would supply an estimated 59 million board feet (MMBF) and 115,000 hundred cubic feet (CCF) of timber volume to the local economy. A total of 13,261 acres of forest that is suitable, available and designated for long-term timber management would be treated with a commercial harvest. An additional 118 acres of commercial harvest would be completed on lands that are not designated for long-term timber management. These include aspen enhancement projects and commercial harvests in sapling-pole structural stages.

The age class distribution for suitable ponderosa pine in the Project Area would shift toward the desired future condition. Development of a more even distribution of age classes is a progressive process as mature stands

are harvested and younger stands are established over time. This alternative would continue this process by removing the overstory on 3,491 acres or about 13 percent of the area of suitable pine. These overstory removal harvests would release the established understory pine and create younger forest stands. The proposed clear cuts would also create young pine stands in the future. Although the short term objective for these clear cut areas is to provide improved wildlife habitat, it is expected that they will eventually fill in with pine seedlings and young pine stands would become established on these sites in the future. Together these stand treatments would create young stands on about 14 percent of the area suitable for timber management within the Project Area.

This alternative also proposes seed cut harvest on 2,299 acres. This harvest method would begin the transition of these stands toward establishing younger stands in the future. Once an understory of pine seedlings and saplings have established on these sites, they will be ready for an overstory removal in the future. The younger stands would occupy an additional nine percent of the area of suitable pine in the future. These treatments would help to establish a progression of age classes.

This alternative would be expected to improve future timber yields from the area by creating additional younger stands and improving the distribution of pine stand age classes. A forest with a higher proportion of younger stands than is currently in the Project Area would be more likely to produce higher yields in the future.

Alternative B would improve stand stocking levels resulting in increased tree and stand growth rates. The decrease in stocking levels would also improve the vigor of the remaining trees, making them less susceptible to attack by insect and disease, particularly mountain pine beetles. These treatments would likely improve the timber yields from the area in the future due to the increased growth rates and the reduced losses to insect and disease.

Stocking levels in many stands would be decreased through commercial as well as pre-commercial thinning. These treatments would increase diameter growth of individual trees and improve the general vigor of these stands. Commercial thinning is proposed over 6,796 acres, or about 26 percent of the area of pine suitable for timber management. The commercial thinning would generally consist of removing suppressed and intermediate trees from mature stands. The remaining co-dominant pine would be left at stocking levels between 40 and 80 square feet per acre. These lower stocking levels are recommended for improving stand growth as well as reducing the risk of a mountain pine beetle infestation.

Pre-commercial thinning is proposed on an additional 195 acres. On these sites only trees less than nine inches in diameter would be cut. The healthiest, largest pine would be retained on a more or less even spacing so that at least 170 trees per acre would remain after treatment. Following this treatment, there would be an increase in individual tree growth due to reduced competition for light, water, and nutrients. Trees would develop larger diameters faster due to this reduction in competition. The age at which these stands reach a commercial size would be reduced by this treatment due to the increased diameter growth.

Mountain Pine Beetle Risk

The proposed treatments would lower the mountain pine beetle risk in the Project Area. Mountain pine beetles generally attack ponderosa pine trees that are located in dense stands (Shepperd and Battaglia 2002).

Stressed trees, such as those in drought areas or in overcrowded stands, are more susceptible to attack (Schmid and Mata 1992). Research has shown that stands with basal areas of less than 80 square feet per acre have a lower risk for infestation (Schmid et al. 1994). Under Alternative B, 6,796 acres of mature ponderosa pine would be thinned to 80 square feet of basal area or less. Once these treatments are complete, the trees remaining in these stands would receive increased sunlight, moisture and nutrients. With increased site resources, these trees may be less susceptible to beetle attack. 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).

Figure 6 displays the amount of area by mountain pine beetle risk rating for each of the alternatives following implementation. Treatments that move high risk rated stands to medium risk stands include thinning to below 80 square feet of basal area. Overstory removals followed by pre-commercial thinning or a clear cut harvest method can reduce a high or medium risk stand to a low risk stand (USDA-Forest Service 2006a).

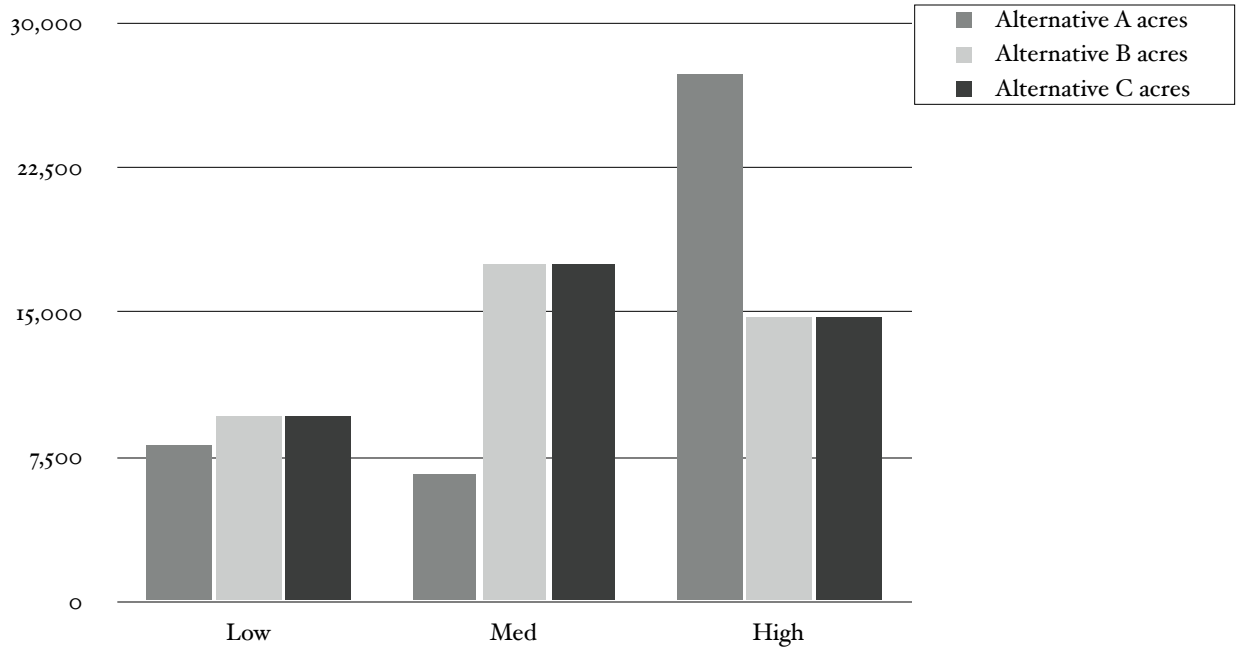

Figure 6. Mountain Pine Beetle Risk Rating within West Rim Project Area by Alternative.

Alternative A represents the existing condition in the Project Area. Alternative B would shift high risk areas to a medium risk rating following treatment. There would also be a shift of some stands into a low risk rating. This shift would not be immediate in stands that are thinned as the trees need time to respond to the decreased densities. However, over a few years, trees in the thinned stands would likely start to respond to the treatments and increase in vigor.

The reduction of area of high risk stands would reduce the potential for losses if a mountain pine beetle epidemic were to develop. However, the likelihood of infestations in healthier trees and less dense stands increases as the overall beetle population increases. Stress conditions caused by drought or large numbers of

invading beetles reduce the effectiveness of the "pitch out" tactic (Shepperd and Battaglia 2002). Alternative B would reduce the potential losses due to mountain pine beetles, but if an epidemic population develops, trees would still be killed.

Alternative B includes a provision for some limited sanitation harvests if new infestations of mountain pine beetles become evident in the Project Area. These harvests would remove ponderosa pine trees that become infested with mountain pine beetles and thin surrounding pine stands that are at risk. This would allow a quick response to new infestations within the Project Area and may help to reduce the likelihood of epidemic populations of mountain pine beetles developing in the area.

Alternative B (Proposed Action) - Cumulative Effects

This section presents the potential cumulative effects of the past, present and future foreseeable actions on the composition and structure of the forest vegetation, timber production and mountain pine beetle risk within the West Rim Project Area. The cumulative effects analysis covers a period of time starting with settlement of the area by Europeans up through five to ten years into the future. The cumulative effects analysis area includes the Project Area as well as adjacent NFS lands where on-going or foreseeable future vegetation management projects could have an effect on the spread of mountain pine beetles or wildfire into the Project Area.

The composition and structure of the forest vegetation within the Project Area as well as across the Northern Hills Ranger District has been affected by the past and present human activities in the area. Settlement, mining, logging, livestock grazing, road building, and fire suppression have all had an influence on the vegetation of area. Intensive logging during the late 1800's and early 1900's removed much of the older forest stands that were present at the time. Much of the forest vegetation that is present in the Project Area today developed after this period. This is shown in the abundance of mature pine that is between 80 and 140 years old (Figure 4). The lack of late successional forest is also the result of this era of intensive logging that removed most of the mature forest present in the late 1800's. This period of intensive logging was followed by a time of aggressive fire suppression. This resulted in the development of a forest that is relatively uniform in age and likely denser than what would have developed had wildfires not been suppressed. Without fire suppression, it is likely that a greater diversity of stand ages and densities would have developed in the area as the result of varying wildfire intensities across the landscape. Some stands may have burned hot enough to result in stand replacement while other areas may have experienced less intense fires that would have killed only a portion of the stand.

Settlement, mining and road building have reduced the amount of forest in some areas as these activities resulted in clearing the land for other uses. These activities also increased the access to the area making it easier to implement forest management activities. The more recent timber harvesting (see Table 11) within the area has resulted in reducing the density of some of the stands, helping to maintain a healthy productive forest. These past and present activities have resulted in an accessible and productive forest. However, the uniformity and density of much the forest vegetation makes the area susceptible to large scale disturbances caused by wildfire or mountain pine beetles.

The actions proposed under Alternative B would help to maintain a productive forest by reducing stocking levels on a large proportion of the area, increasing future production. Some progress would be made towards increasing the diversity of forest vegetation across the landscape by creating younger pine stands and removing pine from meadows and hardwood forests. These actions, combined with the proposed prescribed burning, would reduce the risk of loss from wildfire or a mountain pine beetle infestation. Similar actions proposed on areas adjacent to the Project Area would have a cumulative effect on the structure of the forest vegetation across a larger area. The Griggs fuel management project is adjacent to the West Rim Project Area. This project includes thinning 1,170 acres, prescribed burning 500 acres and the creation of fuel breaks on 326 acres. The Citadel Project Area is also just to the west of the West Rim Project Area. Implementation of this project will begin in the next year. The Citadel project includes vegetative and fuels treatments on a total of 17,780 acres to reduce the density of pine stands and fuel loads. Another future foreseeable action includes the Telegraph project, which is just to the south and east of the West Rim Project Area. This project would address concerns over an increase in mountain pine beetle activity in the area and could involve vegetation treatments similar to those proposed for the West Rim project.

These on-going and future treatments in adjacent areas could have a positive cumulative effect on the forest vegetation of the area. These treatments could reduce the risk of a wildfire or beetle infestation developing in adjacent areas that could spread to the Project Area. These combined actions would reduce the density of forest stands across a larger area and would help to reverse some of the conditions that have resulted from fire suppression.

Alternative C - Direct and Indirect Effects

Alternative C proposes the same treatments as Alternative B with two modifications: the addition of fuel reduction treatments around privately owned structures and additional thinning, piling and burning of natural fuels within Spearfish Canyon (Table 8). The effects of this alternative on vegetative diversity, timber production and mountain pine beetle risk are similar to those described for Alternative B. The additional effects created by 300 foot fuel reduction buffers around privately owned structures and the additional fuel treatments in Spearfish Canyon are discussed below. The fuel reduction treatments are dependent on landowners entering into agreements with the Black Hills National Forest and so the amount that would be implemented is unknown. It is likely that only a subset of the buffer areas would be treated. However, the effects analysis assumes full implementation of these buffer treatments.

Alternative C would add up to 928 acres of fuel reduction treatments which would include up to 568 acres of treatment on NFS land within 300 feet of structures and an additional 360 acres of treatment outside of these structure buffers. Most of these treatments would take place within Spearfish Canyon; only 52 acres of the 568 acres of buffer treatments would be applied around structures outside of the Canyon.

These treatments would remove trees under nine inches in diameter and allow removal of the bottom limbs up to 15 feet high on conifers over nine inches in diameter. Existing ground fuels along with woody fuels created from the cutting of small trees and pruning of larger trees would either be hand piled and burned, or chipped.

Vegetative Diversity

The additional fuel reduction treatments proposed by Alternative C would be conducted primarily in ponderosa pine and white spruce cover types. The amount of understory trees on lands adjacent to private property would be reduced, but the treatments would not result in a change in cover type. In many areas, the treatments would open up the stands enough to increase the amount of sunlight, moisture and nutrients available for understory plants including grasses, forbs and shrubs. These understory plants would be expected to increase following treatment. Inclusions of aspen, birch and oak within the areas treated would also benefit; the amount of these species may increase following fuel reduction treatments. Eventually however, the conifer component of the understory would be expected to return on many of the treated sites. With mature pine and spruce providing seeds, pine and spruce seedlings would become established in the understory. To maintain an area free of ladder fuels it may be necessary to periodically reduce the understory conifers on these sites.

The fuel reduction treatments would have no direct effect on the composition of the overstory trees. However, because the proposed treatments would remove understory conifers and may increase the sunlight reaching the forest floor, there could be a change in the composition of the understory vegetation in some areas such as increased amounts of grasses, forbs and shrubs. The hardwood component may also increase. These effects may result in localized changes in vegetative diversity but would not result in changes to the distribution of cover types in the treated areas.

Forest Successional Stages

Mature ponderosa pine and white spruce stands are the primary forest condition on NFS lands in Spearfish Canyon. This alternative proposes fuel reduction treatments on about 15 percent of the mature forest. The fuel treatments would not move any of these mature stands into an earlier successional stage, although they may reduce the crown cover on some sites. Mature stands with more than a 70 percent crown cover would likely be opened up. In a few areas, where understory conifers exist in abundance, the crown cover may be reduced to below 40 percent. This alternative proposes over 900 acres of fuel reduction treatments, which includes 35 acres of mature structural stage with greater than 70 percent canopy cover. The fuel treatments proposed by Alternative C would have very little effect on the structural stages of the area. Therefore the structural stage changes would be essentially the same as Alternative B (Tables 14 and 15).

Timber Production

The proposed fuel buffers would have no effect on the timber harvest volumes from the area. Most (95 percent) of the fuel buffers proposed by Alternative C are located in the Spearfish Canyon. NFS lands within the canyon are not managed for timber production. In addition, no commercial timber would be harvested from the fuel reduction areas under this proposal.

Mountain Pine Beetle Risk

The additional fuel reduction treatments proposed under Alternative C would have little effect on the mountain pine beetle risk rating of the stands in the area. There could be some areas that currently have high risk characteristics that would move to a medium risk rating following the fuel reduction treatments.

However, these areas would cover less than ten percent of the area treated and reduce the risk rating on less than two percent of the high risk forest within Spearfish Canyon.

Alternative C - Cumulative Effects

This section presents the potential cumulative effects of the past, present and future foreseeable actions on the composition and structure of the forest vegetation, timber production and mountain pine beetle risk within the West Rim Project Area. The cumulative effects analysis covers a period of time starting with settlement of the area by Europeans up through five to ten years into the future. The cumulative effects analysis area includes the Project Area as well as adjacent NFS lands where on-going or foreseeable future vegetation management projects could have an effect on the spread of mountain pine beetles or wildfire into the Project Area.

The cumulative effects of Alternative C on the forest vegetation of the area would be similar to those of Alternative B. The actions proposed under Alternative C would help to maintain a productive forest by reducing stocking levels on a large proportion of the area. In addition, some progress would be made towards increasing the diversity of forest vegetation across the landscape by creating younger pine stands and removing pine from meadows and hardwood forests. These actions combined with the proposed prescribed burning would reduce the risk of loss from wildfire or a mountain pine beetle infestation. Similar actions proposed on areas adjacent to the West Rim Project Area would have a cumulative effect on the structure of the forest vegetation across a larger area. The Griggs fuel management project is adjacent to the Project Area. This project includes thinning 1,170 acres, prescribed burning 500 acres and the creation of fuel breaks on 326 acres. The Citadel Project Area is also just to the west of the West Rim Project Area. Implementation of this project will begin in the next few years. The Citadel project includes vegetative and fuels treatments on a total of 17,780 acres to reduce the density of pine stands and fuel loads. Another future foreseeable action includes a project just to the south of the West Rim Project Area. This project would address concerns over an increase in mountain pine beetle activity in the area and could involve vegetation treatments similar to those proposed for the West Rim project. These on-going and future treatments in adjacent areas could have a positive cumulative effect on the forest vegetation of the area. These treatments could reduce the risk of a wildfire or beetle infestation developing in adjacent areas that could spread to the West Rim area.

Under Alternative C, additional cumulative effects would result from the on-going fuel treatments within the Spearfish Canyon in combination with the fuel treatments proposed under this alternative. Spearfish Canyon 1 is an on-going project, approved through a Categorical Exclusion (CE) that is creating several fuel breaks within the canyon adjacent to highway 14A. This project will create a half mile long fuel break near the mouth of the canyon, and another mile long break near Savoy. Like the fuel break treatments proposed under Alternative C, these on-going treatments will result in more open stand conditions by removing the ground and ladder fuels within treatment areas. The amount of understory vegetation will be reduced within these breaks. Smaller conifer trees will be removed, favoring the hardwood species on these sites. These treatments, in combination with the fuel breaks proposed under Alternative C, could have a cumulative effect on the forest vegetation of the Canyon and surrounding areas. These fuel breaks will reduce the probability of any wildfire spreading into the crowns of the overstory trees. Fires that burn in the crowns of overstory trees can burn hotter and spread faster than a ground fire. Reducing the likelihood of the development of this type

of fire could help retain the mature forest stands within Spearfish Canyon and adjacent areas. These treatments would also slow the development of understory conifers and favor the hardwood species on some sites, resulting in an increase in the hardwood component of these stands and increased diversity. The effects of the fuel buffers on the vegetation would be short-term. Without periodic treatment, understory vegetation would probably become established in response to the more open stand conditions and, over time, young conifers would again develop in many of the treated areas.

3.4 Fire and Fuels

3.4.1 Existing Conditions for Fire and Fuels

Fuel Profile – NFS Lands

Ponderosa pine is the dominant vegetation with large areas of hardwoods and upland meadows interspersed across the Project Area. The forest type distribution in the Project Area is shown in Table 17.

Table 17. Forest Type Distribution in West Rim Project Area

Forest Type	Acres	Percentage of Project Area
ponderosa pine	34,590	80
quaking aspen	3,102	7
white spruce	3,939	9
bur oak	535	1
paper birch	87	0.2
other hardwoods	107	0.2
grass	748	2
other	194	0.4

Aerial Fuels

The Forest Plan objective is to maintain a moderate to low fire hazard over 50 to 75 percent of the NFS land within the WUI boundaries. For NFS land outside the WUI, the objective is to manage the land so that 50 percent of the area has a moderate-to-low fire hazard. Current conditions in the Project Area indicate that only 15 percent of the NFS lands within the WUI and 24 percent of the acres outside of the WUI have a moderate-to-low fire hazard rating. A substantial gap exists between the existing and desired conditions for fire hazard in the Project Area.

The Phase II Amendment correlated crown fire hazard with structural stage in ponderosa pine forests. Table 18 shows the correlation between forest structural stage and crown fire hazard and the area in the affected Management Areas for each structural stage.

Table 18. Structural Stage Relationship to Fire Hazard Rating

Structural Stage	Fire Hazard Rating	Area in affected MAs of Project Area (acres)
Grass/forb	Low	177
Shrub/Seedling	Moderate	899
Sapling-pole; <40% crown cover	Moderate	598
Sapling-pole; 40-70% crown cover	High	116
Sapling-pole; >70% crown cover	Very High	423
Mature; >40% crown cover, diameter > 9”	Moderate	4,508 (all diameters)
Mature; >40% crown cover, diameter < 9”	Very High	see above
Mature; 40 – 70% crown cover, diameter > 9”	High	15,031 (all diameters)
Mature; 40 – 70% crown cover, diameter < 9”	Very High	see above
Mature; >70% crown cover, all diameters	Very High	5205
Late Successional	Very High	615

Figure 7 shows that in the Project Area ponderosa pine stands, only 10 percent of the area is at a low or moderate fire risk rating. This is well below the targeted objectives for both the WUI areas and the NFS lands outside of the WUI.

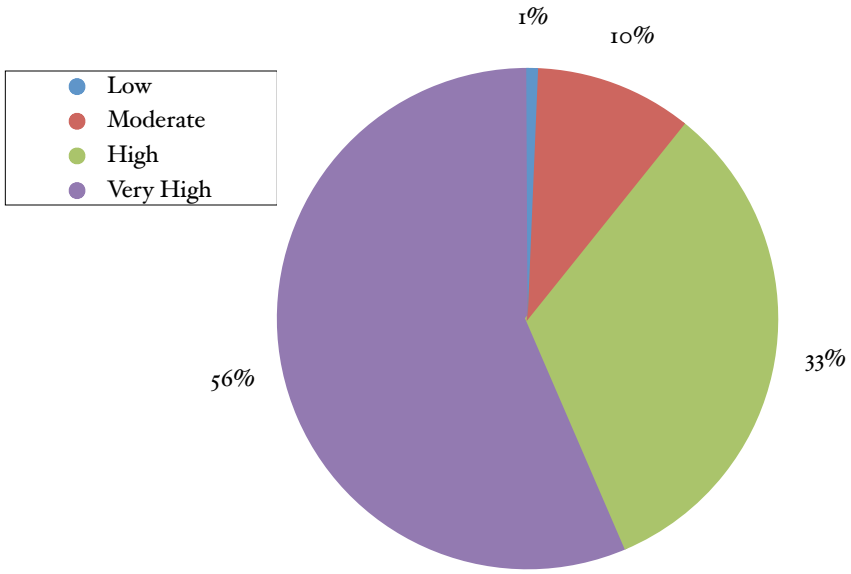

Figure 7. West Rim Crown Fire Hazard Assessment (Ponderosa Pine Stands)

Wildland Urban Interface (WUI)

The Forest Plan objective is to maintain a moderate to low fire hazard over 50 to 75 percent of the NFS land within the WUI boundaries. Current conditions in the Project Area indicate that only 15 percent of the NFS lands within the WUI have a moderate-to-low fire hazard rating. Like the ponderosa pine stands in the Project Area, a substantial gap exists between the existing and desired conditions for fire hazard in the Project Area's WUI.

A list of At Risk Communities was published in the Federal Register (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 land managers could identify priority areas that would benefit from hazard reduction activity. The At Risk Communities located in proximity to the Project Area include: Cheyenne Crossing, Elmore, Englewood, Maitland, Maurice, Savoy, and Spearfish. Figure 8 shows the WUI areas in the Project Area.

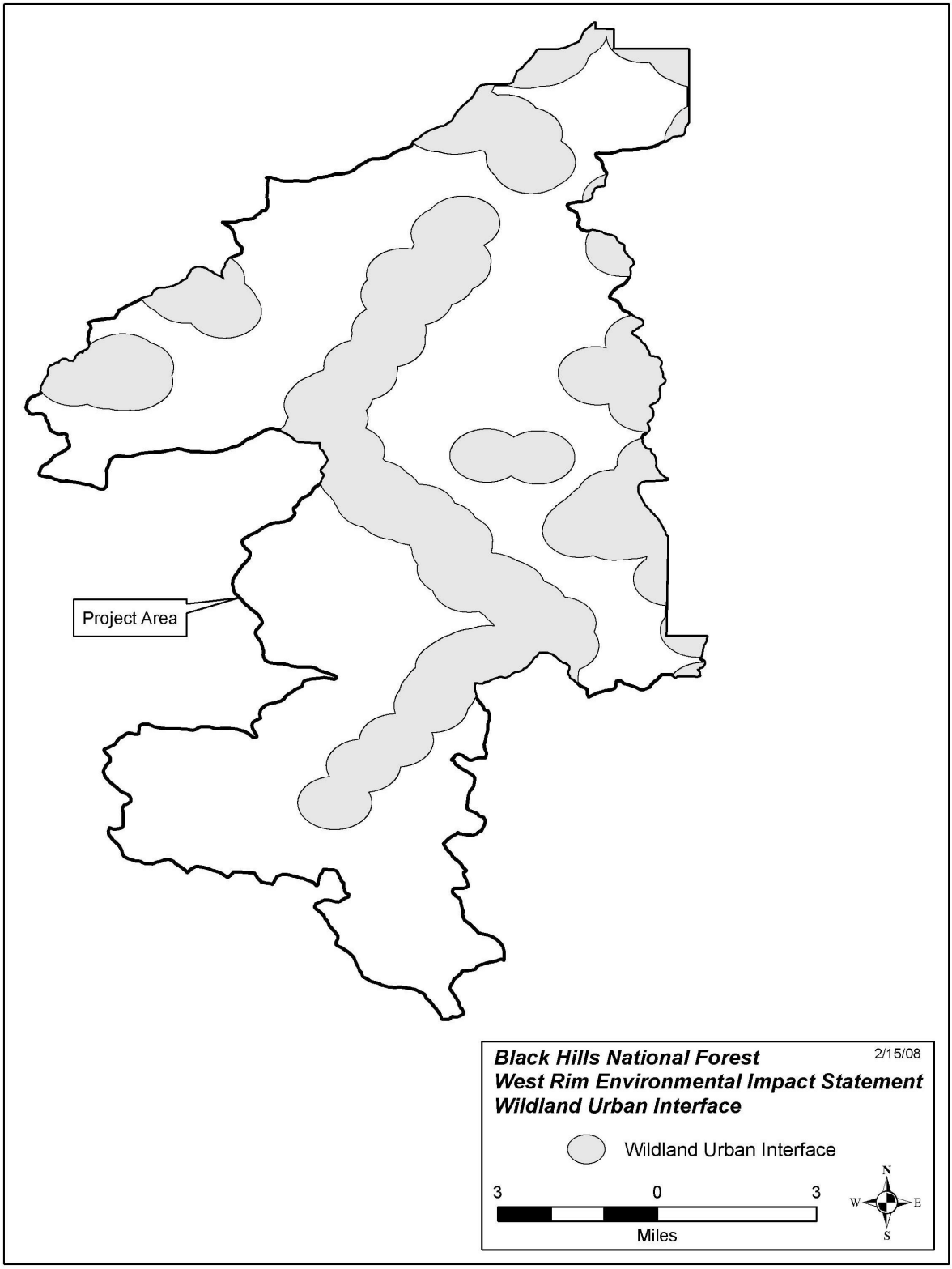

Figure 8. WUI and non-WUI Areas in Project Area

3.4.2 Environmental Consequences for Fire/Fuels

The proposed treatments would meet a variety of fuels management related objectives and would be based on forest health practices. These treatments would also provide wildland fire suppression advantages and include life/safety/property benefits in and around the WUI. Additional benefits include:

- Reintroducing fire into a fire dependent ecosystem.
- Improving the vigor of treated ponderosa pine stands to increase resistance to mountain pine beetle and pine engraver beetle attacks.
- Returning nutrients back into the soil through prescribed burning and/or mechanical mastication of residual vegetative material.
- Protecting soils from the effects of severe wildfire.
- Enhancing plant and animal habitat by releasing hardwood stands from competing conifer encroachment.
- Improving big game habitat and forage opportunities for wildlife by altering stand structure, stand densities, and vegetative species diversity.

The environmental consequences analysis for fire/fuels is bounded by the West Rim Project Area. Short-term effects are those that would occur in the next 5-10 years. Long-term effects are those that would occur in more than 10 years.

Alternative A (No Action)

Only existing and planned activities, approved under other NEPA planning, would occur as a result of this alternative. Ecosystem trends and processes would continue on the current trend. Forest Plan direction, including several goals and objectives, would not be met. Progress toward the desired future conditions as outlined in the Forest Plan would not occur. Management direction outlined in the National Fire Plan, Healthy Forests Restoration Act, and the Lawrence County Wildfire Protection Plan would not be met.

Under Alternative A, wildland fuels in the WUI would not be reduced; no lands near or adjacent to WUIs, or At Risk Communities (ARC) would be treated. There would be no progress toward improving the current fire hazard ratings within the Project Area (Table 19). It would be expected that the fire hazard ratings would increase towards high and very high in areas both within and outside of the WUI. This would be a result of continuing vegetative biomass increases and stand structures that become more mature through annual forest growth. Fire behavior would become more erratic based upon the vegetative changes. When wildfires would occur, such changes in fire behavior would potentially increase losses to private improvements within the Project Area. Although fire suppression activities would continue, these suppression activities could become more difficult and dangerous as the structural stages progress toward higher fire hazard ratings.

Using structural stage as an indicator of crown fire hazard in the Project Area, 85 percent of the NFS lands within the WUI and 76 percent of the NFS lands outside of the WUI would be rated at high and very high (Table 19). This percentage would be expected to increase over-time.

Table 19. Alternative A Fire Hazard in WUI and non-WUI Areas Considered for Treatment

Fire Hazard Rating	WUI (acres)	Percentage of WUI	Non-WUI (acres)	Percentage of non-WUI	Total Acres
Low	1,604	8	3,220	14	4,824
Moderate	1,434	7	2,199	10	3,633
High	7,113	35	7,599	34	14,712
Very High	10,333	50	9,526	42	19,859
Total Acres	20,484		22,544		43,028
Alternative A Treated Acres	0		0		0

Direct and Indirect Effects

Alternative A would have no direct effects. Indirect effects may occur if no treatments are planned or implemented in the Project Area. With no treatment, the stands would continue to mature adding 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 lower the canopy base height. Overstory crowns would continue to grow together increasing the canopy bulk density of the stands, making them susceptible to active crown fire. Fire behavior, especially how it relates to surface to crown fire transition in ponderosa pine stands, would have the potential to become more intense. Crown fire may be sustained more easily once initiated.

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

As the fire hazard 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 increase. The likelihood of a fire escaping initial containment actions would also increase, allowing fires to become larger. Firefighters would be required to take more aggressive actions such as utilizing mechanized equipment, larger burnout operations and more personnel to keep fires small. This would increase suppression costs, increase negative ecological effects and increase exposure of firefighters to erratic fire behavior.

Cumulative Effects

Alternative A would not address national, agency, Forest, or local direction for reducing wildland fuel accumulations beyond existing forest management activities in the short-term. The cumulative effects from not taking actions to reduce wildland fuel accumulations would be an increase in fire hazard and risk as fuel accumulations build above current levels. In the long-term, additional effects to people and the environment from wildfire and suppression activities could be realized.

Alternative B (Proposed Action)

Alternative B proposes treatment with the intent of reducing fire hazard, reducing the risk of mountain pine beetle infestation and increasing structural diversity across the Project Area. Modification of stand structure and reduction in density would be accomplished through harvests and thinning of ladder fuels. Prescribed fire would be used to reduce the amount of available ground fuels and to mimic natural disturbances.

Direct and Indirect Effects

Vegetative treatments have direct and indirect effects on stand structure and fire behavior. Canopy base heights, 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 and treated by lopping and scattering or can be brought to a central location (whole tree yarding). Whole tree yarding would be used in commercially harvested units to limit the amount of surface fuels added to the stand during harvesting. Whole tree yarding typically leaves approximately 25 percent of the total created fuels in the unit. Trees would be yarded by removing the entire tree (bole, branches, and foliage) from the unit and depositing the cut material at a landing site. Unmerchantable material and slash are piled at the landing. Whole tree yarding creates more open-profiled, commercial timber stand that, when compared to multi-structured stands, are more resistant to wildland fire damages. Whole tree yarding is recommended for all commercial harvest treatments proposed except for units with overstory removal, topography, and other ground based harvesting constraints.

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 fuel breaks.

Prescribed fire would be used 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. Prescribed fire also reduces the horizontal continuity of surface fuels which limits surface fire intensity and reduces the potential of spot fire ignition. As a prescribed fire burns over an area, burned fuels settle closer to the ground reducing the fuel bed depth that slows the combustion rate of the remaining fuels. 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 prescribed fire to be safely used as a follow-up treatment to consume surface fuels. Alternative B proposes a combination of mechanical harvest and prescribed fire on 17,363 acres in the Project Area to effectively manage the fuel matrix.

Alternative B would lower the fire hazard ratings in the WUI and non-WUI areas. The proposed treatments would also reduce wildfire risk for some lands near or adjacent to At Risk Communities. Vegetative treatments would affect changes in fire hazard ratings on approximately 4,121 acres in the WUI and approximately 6,310 acres outside the WUI (Table 20). Post treatment, a low to moderate fire hazard rating would exist across 35 percent (7,162 acres) of the WUI and 52 percent (11,729 acres) of the non-WUI areas. These treatments would move the Project Area toward Forest Plan objectives for WUI and non-WUI areas. The improvement in fire hazard rating could enhance fire suppression efforts by reducing the number of acres susceptible to crown fire. Table 20 presents the changes in fire hazard ratings in the treatment area. There would be small increases in the low rating and the major increase in area would be in the moderate fire risk rating. The areas currently rated "very high" would decrease the most.

Table 20. Alternative B Fire Hazard Rating Changes in WUI and Non-WUI Treatment Areas.

Hazard Rating	WUI Existing (acres)	WUI Post Treatment (acres)	WUI Change (acres)	Non-WUI Existing (acres)	Non-WUI Post Treatment (acres)	Non-WUI Change (acres)
Low	1,604	1,650	+46	3,220	3,360	+140
Moderate	1,434	5,512	+4,078	2,199	8,369	+6,170
High	7,113	5,975	-1,138	7,599	5,805	-1,794
Very High	10,333	7,347	-2,986	9,526	5,010	-4,516
Total Acres	20,484	20,484		22,544	22,544	

The Forest Plan objective is to maintain a moderate to low fire hazard over 50 to 75 percent of the NFS land within the WUI boundaries. For NFS land outside the WUI, the objective is to manage the land so that 50 percent of the area has a moderate-to-low fire hazard. Table 21 presents the percentages of land in the "low to moderate" and "high to very high" fire hazard ratings before and after treatment. The table also compares the resulting percentages to the Forest Plan objective.

Table 21. Alternative B Fire Hazard Ratings After Treatment Compared to Forest Plan Objectives

Hazard Rating Category	WUI Forest Plan Objective (% of area)	WUI Post Treatment (% of area)	Non-WUI Forest Plan Objective (% of area)	Non-WUI Post Treatment (% of area)
Low to Moderate	50 to 70	35	50 or more	52
High to Very High	25 to 50	65	50 or less	48

The proposed treatments would alter overstory canopies, understories, and surface and ladder fuels that contribute to a lowering of fire hazard ratings both within and outside of the WUI. Inside and outside of WUI areas, the existing area of low to moderate hazard rating would more than double (8,457 to 18,891 acres). The reduction of fire hazard could contribute to less erratic fire behavior resulting in more effective fire suppression actions, increased firefighter safety, and less damage to natural resources.

Cumulative Effects

The past activities that have had an effect on the fire hazard in the Project Area are taken into account in the existing fire hazard rating. These activities occurred as fuel treatments within the Griggs Fuel Management Categorical Exclusion, the Spearfish Canyon 1 Categorical Exclusion, and the Spearfish Canyon 2 Categorical Exclusion. The present and foreseeable future activities in the Project Area include only the Hanna Timber Sale (37 acres) that would potentially change fire hazard within the Project Area. The effects of treatment actions taken under Alternative B, combined with the effects of other actions would create cumulative impacts on fire hazard ratings within and outside of the WUI. This alternative may increase disturbances from forest management activities in the short-term, but realize fewer effects to people and the environment from wildfire and related suppression activities in the long-term.

Alternative C

Alternative C proposes that, in addition to the vegetative treatments proposed under Alternative B, up to 928 acres of adaptive management fuel reduction buffers would be completed on NFS lands over the next ten years. The adaptive management fuel reduction buffers would be created around all structures in the Project Area, not just in Spearfish Canyon. Additional treatment areas located outside of the canyon are in the vicinity of Aspen Hills, Iron Creek Lake, Terry Peak Subdivision, and Tollgate Flats. The buffers that would be created would extend 300 feet from all structures in the Project Area and some additional areas in Spearfish Canyon

including both private and NFS lands. Treatments would consist of cutting trees under nine inches in diameter and removing the bottom limbs up to 15 feet on conifers over 9 inches in diameter. Existing ground fuels (dead and down fuel) along with woody fuels created from the cutting of small trees and pruning larger trees would be hand piled and burned, subject to approvals and permitting processes.

Direct and Indirect Effects

No identification of crown fire hazard ratings of NFS lands in the buffer zone has been attempted. These areas are very small and are parts of much larger stands, which were assigned fire hazard ratings. These activities would not have a measurable effect upon stand structural stages and subsequently there would not be any changes in fire hazard ratings. The implementation of treatments on private land would be heavily contingent upon funding by the individual landowner and the availability of supplemental or matching funds from other agencies. Should the adaptive management fuel reduction buffer treatment be completed on NFS lands, survivable space would assist in providing greater structural protection in those treated areas.

Cumulative Effects

The cumulative effects for Alternative C are the same as those described under Alternative B. Should the adaptive management fuel reduction buffer treatment be completed on NFS lands, survivable space would assist in providing greater structural protection in those treated areas.

3.5 Wildlife

3.5.1 Introduction

This section discusses the existing conditions and the environmental consequences of vegetation management activities proposed in the Project Area on fish and wildlife species. It summarizes the West Rim Project Wildlife and Fisheries Resource Report (JW Associates 2008c) and the West Rim Project Biological Evaluation/Biological Assessment (BE/BA) (JW Associates 2008d) for wildlife, located in the project record. The proposed actions are targeted 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.

3.5.2 Existing Conditions for Wildlife Habitat

The Project Area is within the Black Hills coniferous forest province ecoregion (Bailey 1995). The climate is temperate steppe. Winters are cold, with temperatures often below freezing. The frost-free season varies from 80 to 140 days, depending on altitude. Annual precipitation, which ranges from 15 to 26 in. (380 to 660 mm), falls mostly as winter snow. Most of the soils are Alfisols (Bailey 1995).

Topography in the Project Area varies and includes limestone cliffs, steep, mountainous terrain, and gently sloping hills and valleys. The elevation ranges from 3,800 feet at the Forest boundary near the mouth of Spearfish Canyon to 6,969 feet at Terry Peak.

Habitat Conditions

Ponderosa pine forest is the dominant habitat, covering about 80 percent of the Project Area. Other important habitat types include white spruce, hardwoods, grasslands and meadows, caves, and riparian and aquatic habitats (see *Section 3.3.1 Existing Conditions for Forest Resources* and Figure 2). In the Black Hills, fire was historically the major factor in shaping the ecological processes in the forest. These fires were generally less severe in nature than the wildfires observed today (see *Section 3.4.1 Existing Conditions for Fire and Fuels*).

The historical fire regime maintained a mature pine canopy with a productive and diverse understory. A century of fire suppression has caused widespread alteration of wildlife habitat in the Black Hills. The absence of frequent low-intensity fires and a corresponding increase in the density and canopy cover of pine stands has created large, contiguous expanses of higher density trees with abundant pine regeneration and sparse understories (Parrish et al. 1996). Fire suppression has also allowed the conversion of hardwood stands such as aspen and bur oak to pine, reducing habitat diversity (Uresk and Severson 1998). Encroachment of pine into meadows and riparian areas has reduced grass, forb, and shrub availability. Fire suppression has thus caused diverse negative impacts on wildlife habitats in the Black Hills.

Ponderosa Pine (Pinus ponderosa) Habitat

Ponderosa pine forest covers about 27,572 acres of NFS land in the Project Area. *Section 3.3.1 Existing Conditions for Forest Resources* provides a discussion of the existing structural stage condition of the Project Area. According to that discussion, early successional structural stages are below Forest Plan objectives, while mature structural stages are above objectives. Across all Project Area Management Areas, late successional stages are below objectives.

White Spruce (Picea glauca) Habitat

Spruce is an ecologically important habitat for a variety of species with Species of Local Concern (SOLC), Management Indicator Species (MIS) and Sensitive Species status. Forest-wide, the spruce cover type is found on 26,483 acres, approximately two percent of the Forest (USDA-Forest Service 2007a). However, the Project Area contains a relative abundance of spruce compared to the Forest as a whole, occurring on approximately 11 percent of the Project Area. Data indicate a long-term upward trend in the area of spruce, although it remains an ecologically limited component of the Forest. Spruce has replaced pine on cool moist sites as a result of fire suppression, outbreaks of insects that affect pine, and silvicultural treatment (Alexander and Edminster 1981). On drier sites it appears that spruce may increase, but pine will remain dominant (USDA-Forest Service 1996a). Late successional white spruce habitat has been identified on 101 acres of affected MAs.

Hardwood Communities

Aspen and bur oak stands provide important cover, browse, or nesting habitat for a variety of wildlife species. The Project Area includes approximately 3,102 acres of aspen, 535 acres of bur oak, and 107 acres of other hardwoods (see Silviculture Resource Report 2008). There are 83 acres of paper birch, which tend to occur in or near riparian areas. Ponderosa pine is encroaching into many hardwood community types as a result of fire suppression. Loss of these stands has a negative impact on the overall diversity of wildlife habitat.

Grasslands and Meadow Habitat

Grasslands are an important aspect of the Black Hills ecosystem as they provide critical habitat for a variety of plant and animal species. The Project Area includes 748 acres of grassy meadows, some of which are wet meadows. Grasslands and meadows tend to be interspersed among forested areas in the Project Area and 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.

Caves and Mines

There is one known cave (Community Cave) and 32 known abandoned mines with open audits in the Project Area. There was no sign of bats (no scat present in July 2007) in Community Cave. None of the abandoned mines have ever been surveyed for bats. The depth and complexity of the openings in Community Cave and in all the abandoned mines, and the likelihood of bats using these structures for roosting, is unknown. It is, however, highly likely and probable that bat roosting habitat occurs in snags and in cracks and crevices along cliff edges throughout Spearfish Canyon (USDA-Forest Service 2007c).

Riparian/Aquatic Habitat

Riparian and aquatic areas in the Project Area are concentrated around Spearfish Creek and its tributaries. Twenty-seven miles of Spearfish Creek runs through the Project Area, along with 5.53 miles of Iron Creek, a tributary of Spearfish Creek. The mouth of Little Spearfish Creek and East Spearfish Creek also occur within the Project Area (USDA-Forest Service 2007e).

The structure and composition of the riparian areas throughout the Black Hills and in the Project Area has changed over the past century due to a number of influences. Fire suppression may have had impacts (USDA-Forest Service 2005c) as fire stimulates regeneration in species such as aspen and opens up habitat for other earlier seal types (Mariot and Faber Langendon 2000b). Other human related influences in the Project Area include mining, trampling of the stream bank from livestock grazing and road construction for timber harvest activities.

Suitable fish habitat in the Project Area includes the following perennial streams: Spearfish Creek, all of Annie, Cleopatra (formerly known as Squaw) and Iron Creeks and Icebox, Intake, Raddick and Rubicon Gulches. Iron Creek Lake and the Yates Pond Complex also provide suitable fish habitat (USDA-Forest Service 2007d). Past and current activities have degraded habitat quality for native fishes. These activities are discussed in the Fisheries Existing Conditions Report (USDA-Forest Service 2007d) and the West Rim Project Hydrology/Soils Resources Report (JW Associates 2008f) and summarized in the West Rim Project Wildlife Resources Report (JW Associates 2008c).

3.5.3 Environmental Consequences for Wildlife Habitat

Alternative A (No Action)

Thee would be no direct effects of Alternative A (No Action), as no new actions would occur. Long-term, indirect effects would vary depending on habitat type. In general, Alternative A would maintain existing habitat and protect biodiversity in the short-term. Long term, the proportion of ponderosa pine cover type in the Project Area would be expected to rise as this species continued to encroach into existing meadows and hardwood stands. Early successional habitats would continue to decline as pine stands continue to progress toward later seral stages. Currently, late successional habitat is below management objectives in the Project Area and Forest-wide. Over the next ten to twenty years some of the mature stands could develop into late successional habitats. However, this alternative would not provide for a variety of successional stages, which would reduce habitat diversity and not comply with forest objectives. Natural disturbances such as wildfires and beetle outbreaks would continue to return portions of the forest in which they occur to early successional stages.

Effects for important habitat components in the Project Area, as well as the species that may be affected are described in Table 22.

Table 22. Alternative A - Direct and Indirect Effects to Wildlife Habitat

Ecosystem	Alternative A Direct effects	Alternative A Indirect effects	Sensitive Species impacted
Ponderosa Pine	None	Additional dense, late successional stands with closed canopy would develop. The amount of snags is likely to increase. These stands would have an increased risk of mountain pine beetle infestation and wildfire risk returning areas back to earlier successional stages.	Black-Backed Woodpecker, Flammulated Owl, Lewis's Woodpecker, Northern Goshawk, American Marten, Fringed Myotis, Townsend's Big-Eared Bat, Cooper's Mountain Snail
White Spruce	None	White spruce as a component of the ecosystem would continue to increase within its ecological limits.	American Three-toed woodpecker, Flammulated Owl, American Marten
Hardwood	None	Pine encroachment would continue to reduce areas dominated by aspen.	Black Hills Redbelly Snake
Grassland/ Shrubland	None	Pine encroachment would continue to reduce meadow habitat.	Regal Fritillary, Loggerhead Shrike
Riparian/ Wetland	None	Fragmentation by existing dams and roads would persist.	Fringed Myotis, Townsend's Big-Eared Bat, Black Hills Redbelly Snake, Northern Leopard Frog, Cooper's Mountain Snail
Aquatic	None	Stream fragmentation would persist due to existing structures. Water quality would continue to be influenced by ongoing federal/ non-federal activities. Drought may continue to reduce stream flows and connectivity.	Mountain Sucker, Northern Leopard Frog

The existing habitat conditions are the result of the past and present human activities on the National Forest System and private lands within the Project Area. There have been nine active timber sales in the area in recent years covering an area of 5,114 acres and one planned sale on 37 acres. These sales have reduced density in some stands in the Project Area. Without additional active forest management over the next 20 years, ponderosa pine density in the Project Area would likely increase and structural diversity decrease. Such conditions would reduce habitat diversity overall. The alternative would also contain the largest risk of wildlife and pine beetle outbreak which could return areas of the forest in which they occur to early successional stages. Should stand replacing wildlife occur, increased erosion, runoff and sediment yield could negatively impact riparian and aquatic areas (JW Associates 2008f).

Alternative B (Proposed Action)

Alternative B (Proposed Action) is designed to meet the forest objectives for structural stage management. Although there would be short-term impacts to wildlife habitat, there would be long-term improvements in the quantity, diversity, and quality of habitat. Hardwood enhancement treatments would increase the area of aspen by about 528 acres and the area of oak by 85 acres. The meadow enhancement would enhance 37 acres of grassland, reducing ponderosa habitat by two percent in the Project Area.

The diversity of understory plants would increase in many pine stands due to reduced forest canopy cover and disturbance caused by logging and prescribed fire. Many of the proposed treatments would open up dense stands, providing increased sunlight, moisture and nutrients for grasses, forbs and shrubs. Inclusions of aspen, birch and oak within these pine stands may also benefit. Disturbance created by prescribed fire would help stimulate the regeneration of the less shade tolerant plant species within these stands.

Many of the proposed treatments within the ponderosa pine stands of the area would have an effect on the stand structural stage. Changes in structural stage within each MA are discussed in detail in the West Rim Project Silvicultural Resources Report (JW Associates 2008a). In Spearfish Creek riparian area, two small fuel reduction projects are proposed to remove small diameter conifers from aspen, oak and cottonwood stands.

The effects to habitats due to the treatments proposed in Alternative B are provided in Table 23. Relevant Forest Plan standards and objectives, met by the use of specific design criteria (Appendix B), would be applied to mitigate the impacts in the Project Area.

Table 23. Alternative B - Direct and Indirect Effects to Wildlife Habitat

Ecosystem	Direct effects for proposed action alternative	Indirect effects for proposed action alternative	SS impacted	Relevant Forest Plan standards, objectives, guidelines
Ponderosa Pine	Commercial and non-commercial thinning, prescribed burn, overstory removal. Removal of approximately 12,000 acres of mature, dense forest. Reduction of one late successional stand of 56 acres in MA 5.1.	Reduction of pines in dense, mature structural stages and increase in younger, less dense stages for all MAs. Maintenance of structural stage 5 at levels below objective of 5% in all MAs. Long-term progress towards all structural stage objectives.	Black-Backed Woodpecker, Flammulated Owl, Golden Eagle, Lewis's Woodpecker, Northern Goshawk, American Marten, Fringed Myotis, Townsend's Big-Eared Bat, Cooper's Mountain Snail	Objective 211 - provide an avg. of 3 snags/acre Objective 212 - provisions for dead downed material in conifer-forested areas <u>Snag Standards</u> 2305 - all soft snags except those deemed safety hazards would be maintained. 2301 - large snags to be maintained except when a safety hazard. Hardwood snags to be maintained at a density of at least 6/acre.
White Spruce	Reduction of spruce as a result of pine management activities.	Overall change in acreage of spruce should be minimal.	American Three-toed woodpecker, Flammulated Owl, American Marten	Objective 239 - maintain 20,000 acres of spruce across the Forest.
Hardwood	1,000 acres treated with commercial and non-commercial thinning and prescribed burn.	Increase in hardwoods due to reduced pine competition.	Black Hills Redbelly Snake	Objective 201 - manage for 92,000 acres of aspen and 16,000 acres of bur oak forest wide. Emphasis on hardwood restoration where conifers have outcompeted hardwood.
Grassland/ Shrubland	Approx. 225 acres treated by clear cut and meadow enhancement and maintained as meadows.	Enhancement of meadow habitat due to reduction in pine encroachment	Regal Fritillary, Loggerhead Shrike, Rocky Mountain Big Horn Sheep	Objective 205 - maintain 122,000 acres grasslands and 3,600 acres meadow across the Forest

Table 23. Alternative B - Direct and Indirect Effects to Wildlife Habitat (continued)

Ecosystem	Direct effects for proposed action alternative	Indirect effects for proposed action alternative	SS impacted	Relevant Forest Plan standards, objectives, guidelines
Riparian/ Wetland	Effects would include habitat loss at road crossings. Short-term habitat loss in the vicinity of the road crossing during construction.	Fuel reduction treatments in Spearfish Canyon may enhance aspen, oak and cottonwood in the riparian area. Bank stabilization may decrease due to new stream crossings (refer to Hydrology Report, JW Associates 2008f)	Fringed Myotis, Townsend's Big-Eared Bat, Black Hills Redbelly Snake, Northern Leopard Frog, Cooper's Mountain Snail	Objective 213 - maintain riparian biodiversity. Objective 214 - restore riparian shrubs. Guideline 3212 - manage for high quality riparian areas. Standard 3106 - avoid riparian areas with SS during ground disturbance activities Standard 2505c - limits the use of willows Standard 1113 - minimizes sediment discharge. Standard 9107 - prohibits vehicles from entering perennial steams. Standard 9108 - restricts vehicle traffic. Standard 1305 - restricts camping sites for contractors.
Aquatic	Potential for short-term impacts from sedimentation during silvicultural treatment, road construction and use.	Sedimentation may increase due to new stream crossings (refer to Hydrology Report, JW Associates 2008f)	Mountain Sucker, Northern Leopard Frog	Objective 219-maintain or improve instream fisheries. Standard 1301- in WIZ actions to maintain stream habitat. Standard 1201- maintain or improve stream health. Standard 1203- design and construct stream structures to allow for passage of aquatic wildlife.

Alternative C

Alternative C includes all actions of Alternative B and additional fuel mitigation activities in Wildland Urban Interface (WUI) areas (as defined by 300 ft. structure buffers) and additional areas in Spearfish Canyon. Treatments would affect 928 acres of additional National Forest System land over the next ten years. The majority of treatments would be concentrated along the Spearfish Creek riparian area.

Effects for Alternative C would include all effects discussed under Alternative B and the additional effects described below. The additional effects due to this alternative would be greatest on the riparian and aquatic habitats and species within those ecosystems. The remainder of this analysis will focus exclusively on fuels treatments added under Alternative C.

Mature ponderosa pine and white spruce stands are the primary forest condition on National Forest System lands within Spearfish Canyon. The amount of understory trees on lands adjacent to private property would be reduced, but the treatments would not result in a change in cover type. Therefore, the expected change in successional stages would be about the same as for Alternative B. Table 24 provides additional effects to habitats and indicates which species would be affected. Only those species for which Alternative C would have additional effects are presented in the table. Appropriate Forest Plan standards, objectives, and guidelines would be applied through Project Area design criteria (Appendix B) to mitigate the impacts.

Table 24. Alternative C – Direct and Indirect Effects to Wildlife Habitat

Ecosystem	Additional Direct effects under Alternative C	Additional indirect effects under Alternative C	R2 SS impacted	Relevant Forest Plan standards, objectives, guidelines
Ponderosa Pine	Within WUI buffers: fuel treatments within 300 feet of residences. Additional fuel mitigation treatments in Spearfish Canyon (360 acres). Treatments limited to limbing of conifers (>9in dbh) and removal of conifers (<9in dbh).	Same as Alternative B with additional acres of fuels treatments in ponderosa pine habitat.	Black-Backed Woodpecker, Flammulated Owl, Lewis's Woodpecker, Northern Goshawk, American Marten, Fringed Myotis, Townsend's Big-Eared Bat, Cooper's Mountain Snail	Objective 211 - provide an avg. of 3 snags/acre Objective 212 - provisions for dead downed material in conifer-forested areas <u>Snag Standards</u> 2305 - all soft snags except those deemed safety hazards would be maintained. 2301 - large snags to be maintained except when a safety hazard. Hardwood snags to be maintained at a density of at least 6/acre.
White Spruce	Within WUI buffers: fuel treatments within 300 feet of residences. Fuel mitigation in Spearfish Canyon (360 acres). Treatments limited to limbing of conifers (>9in dbh) and removal of conifers (<9in dbh).	Same as Alternative B with additional acres of fuels treatments in spruce habitat.	American Three-toed woodpecker, Flammulated Owl, American Marten, Cooper's Mountain Snail	Objective 239 - maintain 20,000 acres of spruce across the Forest.
Hardwood	No hardwoods would be removed in fuel treatment activities. Conifers (<9in dbh) would be removed from hardwood stands. Birch dominated stands would be avoided.	Same as Alternative B with additional acres of fuels treatment in hardwood stands.	Black Hills Redbelly Snake, Cooper's Mountain Snail	Objective 201 - manage for 92,000 acres of aspen and 16,000 acres of bur oak forest wide. Emphasis on hardwood restoration where conifers have outcompeted hardwood.
Grassland/ Shrubland	Small conifers (<9in dbh) may be removed from grasslands	Same as Alternative B.	Regal Fritillary, Loggerhead Shrike	Objective 205 - maintain 122,000 acres grasslands and 3,600 acres meadow across the Forest.

Table 24. Alternative C – Direct and Indirect Effects to Wildlife Habitat (continued)

Ecosystem	Additional Direct effects under Alternative C	Additional indirect effects under Alternative C	R2 SS impacted	Relevant Forest Plan standards, objectives, guidelines
Riparian/ Wetland	Piling and burning of cut materials, removal of conifers less than 9"dbh in WUI buffer zones and removal of cut material would occur in riparian areas. In Spearfish Canyon, fuels treatments would impact road to toe slope (the entire floodplain) in some areas.	Disturbance in riparian area could increase bank destabilization, particularly in Spearfish Canyon.	Fringed Myotis, Townsend's Big-Eared Bat, Black Hills Redbelly Snake, Northern Leopard Frog, Cooper's Mountain Snail	Objective 213 - maintain riparian biodiversity. Objective 214 - restore riparian shrubs. Guideline 3212 - manage for high quality riparian communities. Standard 3106 - Riparian areas with SS to be avoided during ground disturbance activities. Standard 2505c - limits the utilization of willows. Standard 1113 - minimizes sediment discharge. Standard 9107 - prohibits vehicles from perennial steams. Standard 9108 - restricts vehicle traffic. Standard 1305 - restricts camping sites for contractors.
Aquatic	Same as Alternative B, with additional impacts to Spearfish Creak from 928 acres of fuels treatments in the Project Area, mostly within Spearfish Canyon.	Disturbance in riparian area could increase erosion and sediment loading in Spearfish Creek.	Mountain Sucker, Northern Leopard Frog	Objective 219 - maintain or improve instream fisheries. Standard 1301 - in WIZ actions to maintain stream habitat. Standard 1201 - maintain or improve stream health. Standard 1203 - design and stream structures to allow for passage of aquatic wildlife.

3.5.4 Threatened and Endangered Species

Based on consultation with the USFWS, it has been determined that no currently listed species with Threatened, Endangered or Pending status have the potential to occur within the Northern Hills Ranger District on the Black Hills National Forest, nor has "critical habitat" been designated for any Threatened or Endangered species on the Forest. Therefore, no federally listed species are addressed in this document and there will be "no effect" to Threatened and Endangered species and no impact to critical habitat.

3.5.5 R2 Sensitive Species (SS) and Management Indicator Species (MIS)

Sensitive species are those plant and animal species identified by the Regional Forester for which population viability is a concern, as evidenced by:

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

MIS are selected at the Forest level scale because their habitats are representative of a variety of habitats and can indicate overall changes to the forest ecosystem. MIS were selected to evaluate the effects of Forest Plan implementation and natural change of the Forest on species that rely on similar habitat needs. Population changes are believed to indicate the effects of management activities.

Several of the Sensitive Species are also MIS and are therefore discussed together in this section. Tables 25, 26 and 27 present a list of those species that are known to occur, or whose habitat occurs, within the Project Area. Several other Sensitive Species or MIS are found on the Forest, however, their habitats are not found in the Project Area. If an MIS or its habitat were not found in the Project Area, it was not identified for further analysis. These species include:

1. Burrowing Owl (*Athene cunicularia*) – Sensitive species
2. Grasshopper Sparrow (*Ammodramus savannarum*) – Sensitive species and MIS
3. Northern Harrier (*Circus cyaneus*) – Sensitive species
4. Peregrine Falcon (*Falco peregrinus*) – Sensitive species
5. Yellow-billed Cuckoo (*Coccyzus americanus*) – Sensitive species
6. Black-tailed Prairie Dog (*Cynomys ludovicianus*) – Sensitive species
7. Finescale Dace (*Phoxinus negogaeus*) – Sensitive species
8. Lake Chub (*Couesius plumbeus*) – Sensitive species

This analysis is bounded by the Northern Hills Ranger District Boundary and a 20-year time period. Relevant actions on federal and non-federal land assessed in the analysis are discussed below.

Table 25. Evaluation and Description of Black Hills National Forest Bird Sensitive and MIS Species and Habitats

Species	Status	Species Documented?	Rationale
American Three-Toed Woodpecker (*Picoides tridactylus*)	SS	Yes	Occur almost exclusively in mature spruce stands (Beason et al. 2006).
Bald Eagle (*Haliaeetus leucocephalus*)	SS	Yes Wintering bald eagles only.	Usually found near open water or carrion (Tallman et al. 2002); only one nest and one winter roost has been documented in the Forest and neither are within ½ mile of the Project Area. Wintering and migrating eagles may use the Project Area.
Black-Backed Woodpecker (*Picoides arcticus*)	SS, MIS	Yes	Recently burned areas (within 5 years) with a high density of pre-burn snags and/or mature forests with a high snag density (Anderson 2003, Panjabi 2003). Species rare outside burned areas (Beason et al 2006).
Brown Creeper (*Certhia americana*)	MIS	Yes	Late successional ponderosa pine and white spruce (Beason et al. 2006).
Flammulated Owl (*Otus flammeolus*)	SS	Yes	Open ponderosa pine forests (Hayward and Verner 1994).
Golden-crowned Kinglet (*Regulus satrapa)*	MIS	No	Breeds almost exclusively in white spruce habitat (Beason et al. 2006).
Lewis's woodpecker (*Melanerpes lewis*)	SS	Yes	Open burned areas with large snags; oak and cottonwood forests and open, parklike ponderosa pine forests (Anderson 2003, Panjabi 2003).
Loggerhead Shrike (*Lanius ludovicianus*)	SS	1 observed	Open country with scattered, low deciduous thickets (Tallman et al 2002). Breeding records occur near periphery but not interior or higher elevations of Black Hills (Peterson 1995).
Northern Goshawk (*Accipiter gentilis*)	SS	Yes	Nests primarily in dense, mature coniferous forests; Forages in a variety of forested areas and small openings (Kennedy, 2003).
Ruffed Grouse (*Bonasa umbellus*)	MIS	Yes	Occur widely throughout Black Hills in hardwood communities; may require variety of aspen structural stages (USDA-Forest Service 2005c).
Song Sparrow (*Melospiza melodia*)	MIS	No	Found mostly in dense, riparian vegetation in the Black Hills (Beason et al. 2006).

Table 26. Evaluation and Description of Black Hills National Forest Mammal and Reptile/Amphibian Sensitive and MIS Species and Habitats

Species	Status	Species Documented?	Rationale
American Marten (*Martes Americana*)	SS	Yes	Spruce forests with complex near-ground structure, extending into adjacent ponderosa pine stands (Buskirk 2002).
Beaver (*Castor canadensis*)	MIS	Yes	Riparian habitat dominated by stands of willow, aspen and cottonwood; do not use areas lacking permanent water and suitable woody vegetation (USDA-Forest Service 2005c).
Fringed Myotis (*Myotis thysanodes pahasapensis*)	SS	Yes	Found at higher elevations in spruce habitat and mixed ponderosa pine, spruce and aspen habitat; roosts in a variety of structures including caves, mines, tunnels, snags and buildings (Schmidt 2003a).
Rocky Mountain Bighorn Sheep (*Ovis canadensis*)	SS	Yes	Cliffs, rock outcrops, and nearby meadows. Limited primarily to areas around Sheridan Lake, Dark Canyon (Rapid Creek), Spring Creek, and Custer State Park (USDA- Forest Service 2005c).
Townsend's big eared bat (*Plecotus townsendii*)	SS	Yes	Forages on insects in a variety of habitats including forested and wet areas; requires suitable roots in a variety of structures including caves, mines, or rock ledges and overhangs (Schmidt 2003b).
White-tailed Deer *(Odocoileus virginianus)*	MIS	Yes	Various habitats from forests to fields with adjacent cover; wooded draws and pine stands with closed canopies provide thermal cover, while agricultural areas and recently logged and open stands with abundant shrubs are important for foraging.
Black Hills Redbelly Snake (*Storeria occipitomaculata pahasapae*)	SS	Yes	Moist habitats with well developed areas for tadpoles, sub adults and breeding adults; adults forage in upland habitats (Smith 2003)
Northern Leopard Frog (*Rana pipiens*)	SS	Yes	Riparian and wetland areas for sub-adults and breeding adults; adults forage in upland habitats (Smith 2003).

Table 27. Evaluation and Description of Black Hills National Forest Fish and Invertebrate Sensitive and MIS Species and Habitats

Species	Status	Species Documented?	Rationale
Mountain Sucker (*Catostomus platyrhynchus*)	SS, MIS	Yes	Occurs most often in cool, clear mountain streams, but have also been observed in large rivers, lakes and reservoirs (Isaak et al 2003). It occurs in Annie Creek within the Project Area.
Cooper's Mountain Snail (*Oreohelix strigosa cooperi*)	SS	Yes	Found on calcareous soils, lowland wooded area and talus slopes, generally not always associated with northern or eastern exposures. In contrast to other land snails, can thrive with thin litter (Anderson 2005).
Regal Fritillary (*Speyeria idalia*)	SS	Yes	Tall-grass prairie; continuous prairie near marshes (Marrone 2005); greater then 1000 acres may be required for stable populations (Royer and Marrone 1992). Best habitat in Black Hills occurs in lower elevations along Forest boundary and in interior prairies (at least 250 acres in size) (USDA-Forest Service 1996a).

The species listed in Tables 25, 26 and 27 are discussed in detail in this section. The existing condition discussion (Habitat and Range, and Occurrence in and Near Project Area) is followed immediately by the Environmental Consequences for that specific species. The intention is to allow the reader to more easily follow the status of, and consequences of implementation for, each species.

American Three-Toed Woodpecker (*Picoides tridactylus*) - Sensitive Species

This species was selected as a Sensitive Species due to long term declines that have likely been caused by habitat change from fire suppression and post-fire salvage logging (USDA-Forest Service 2007e).

Habitat and Range

The main range of the three-toed woodpecker extends through the Rocky Mountains and laterally across Canada to northern New England (Leonard 2001). In South Dakota, this woodpecker is considered a rare yearlong resident limited to the higher elevations of the Black Hills (South Dakota Ornithologist's Union 1991).

Habitat for the American three-toed woodpecker occurs exclusively in mature spruce stands (Beason et al. 2006). Late successional spruce-fir forest represents the core breeding and feeding habitat for the species (Wiggins 2004). Three-toed woodpeckers nest mainly in snags but will use live trees, especially those with heart rot. This species is also closely tied to insect outbreaks following disturbances; particularly fire, as well as diseases, flooding, and windthrow (Leonard 2001). In other locations, woodpecker densities have been much higher in recently burned areas than in unburned areas (Anderson 2003).

Occurrence in and Near the Project Area

Local population trends are not clear. Breeding bird surveys suggest possible local declines (Sauer et al. 2008), although observations have indicated a slight increase in Forest-wide numbers. Monitoring results show areas

in or adjacent to mature white spruce stands harbor the highest three-toed woodpecker densities in the Black Hills. Birds were also found, in lower densities, in late-successional pine habitats and riparian habitats. However, Panjabi (2001, 2003, and 2004) has not found them in ponderosa-pine burns in the Black Hills. Burned spruce likely harbors the species, but this habitat has not been monitored in the Black Hills.

Three-toed woodpeckers and their nests have been observed in the Project Area (USDA-Forest Service 2007b). Suitable spruce habitat exists on 3,939 acres of the Project area.

Environmental Consequences for American Three-Toed Woodpecker

Alternative A (No Action)

In the Black Hills, three-toed woodpeckers are associated primarily with white spruce habitat with available snags and can also be found in late successional pine forests and riparian areas. Assuming a continuation of fire suppression policies, both white spruce habitat and late successional pine forest would be expected to increase. Dense late successional stands would lead to an increased risk of mountain pine beetle infestation and wildfire. Recently burned areas provide optimal habitat for three-toed woodpeckers in other locations, and although this relationship has not been verified on the Forest, burning could provide enhanced habitat. However, current conditions promote high intensity wildfires that may not result in optimal post-fire conditions for the species. In the absence of stand replacing fire, this alternative is likely to produce an increase in available habitat for the three-toed woodpecker.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Direct effects to this species include a small potential for individual mortality due to timber felling or other management activities, especially in spruce habitat. Overall, the area of spruce could be reduced slightly by both Alternatives B and C, particularly in ecotones where pine and spruce come together. In these alternative there is no planned reduction of spruce in aspen. In the Project Area, marten corridors are identified and protected by the use of specific design criteria. These corridors are spruce dominated, so protection for marten would also minimize the loss of spruce habitat. Some snags may be lost during harvest activities. However, all snags except those deemed safety hazards would be maintained, thereby assuring long-term supply. Snag standards are met in the Project Area through the use of specific design criteria for snags. Overall, spruce dominated stands and snags would be preserved, assuming design criteria are followed.

The direct and indirect effects of Alternatives B and C may adversely impact individuals, but are not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of Alternatives B and C, combined with the past, present and reasonably foreseeable future actions, would not change habitat availability for American three-toed woodpecker within and adjacent to the Project Area. While the West Rim project would slightly reduce spruce, there are no other large-scale efforts in the Project Area to reduce spruce habitat. Therefore, there would be no cumulative change to habitat on NFS lands for the three-toed woodpecker.

Privately owned lands within and adjacent to the Project Area may also provide suitable breeding and winter habitat for the three-toed woodpecker. Landowners may treat forests for lumber or to reduce fire hazards, which could reduce habitat if mature spruce stands are treated. This would likely increase the importance of habitat located on NFS lands.

Bald Eagle (*Haliaeetus leucocephalus*) - Sensitive Species

The bald eagle was recently removed from the List of Endangered and Threatened Wildlife (Federal Register 2007) due to recovery range-wide. Its population in the lower 48 states has increased from approximately 487 to 9,789 breeding pairs (1963-present). The species is now a Region 2 Sensitive Species.

Habitat and Range

The range of the bald eagle includes most of Canada and Alaska, all the contiguous United States, and northern Mexico. Bald eagles are closely associated with water and are rarely seen far from aquatic environments. They are usually found near open water or carrion (Tallman et al. 2002), particularly where fish are available or waterfowl congregate. They were not known to nest in the Black Hills historically; however, one pair of eagles was documented nesting in the southern Hills in 2004 (USDA-Forest Service 2005b).

Occurrence in and Near the Project Area

Wintering and migrating bald eagles have been documented in the Project Area. There is only one known active nest (documented spring 2007, nest was not successful) and one known winter roost site (recorded December 2005) in the Black Hills. Neither site is within ½ mile of the Project Area. Concentrations of wintering eagles (winter roost sites) are not likely to occur anywhere in the Project Area. During migration, bald eagles are common but occur sporadically throughout the Project Area. Temporary roost sites during migration are determined primarily by the availability of carrion.

Environmental Consequences for Bald Eagle

Alternative A (No Action)

There would not be any impacts to breeding or roosting sites, since none are known to occur in or within ½ mile of the Project Area. Potential roosting habitat does exist in mature and late successional structural stages. As forest succession continues, some increase in mature forests may occur. Wildfire and beetle outbreaks would continue to return some areas of the forest to early successional stages. In the absence of stand replacing fire, habitat for this species is expected to increase, although open water and availability of carrion during the winter months will remain the primary limiting factor for the species in the Project Area.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Migrating or wintering birds are likely to avoid the area during timber harvest or prescribed burn activities, so there could be some short-term effects. There are no nesting or roosting sites in or within ½ mile of the Project Area, therefore no impacts to breeding or roosting habitat are anticipated. The primary winter food source, deer carrion, would continue to be available. Habitat conditions for deer across the Forest are likely to remain stable or increase, and management activities proposed for the Project Area would enhance deer habitat and may further increase deer numbers, benefiting the eagle.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of Alternatives B and C combined with the past, present and reasonably foreseeable future actions would result in no measurable change of habitat available for bald eagles within and adjacent to the Project Area. Habitat for prey would also continue to exist in the Project Area. Human disturbance due to roads and trails may contribute to cumulative effects. However, most human use is concentrated in the spring, summer and fall, therefore effects of migrating and wintering bald eagles is likely to be minimal. Suitable roost trees exist on private in-holdings. Human activity may limit roosting on some of these non-NFS lands.

Alternatives B and C may adversely impact individuals, but are not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide. Lack of breeding areas would limit the impacts of all alternatives.

Black-Backed Woodpecker (*Picoides arcticus*) - Sensitive Species and MIS

The black-backed woodpecker was selected as an MIS to evaluate the effects of Forest Plan implementation and natural change on the ability of the Forest to support species that rely on mature and late successional forest, burned forest, insects, and snags to meet their needs (USDA-Forest Service 2005a). This species was selected as a sensitive species due to dependence on habitat that has been adversely affected by salvage logging and fire suppression.

Habitat and Range

Black-backed woodpeckers are residents from Alaska across Canada to Newfoundland, southward to California, northern Wyoming, Wisconsin, northern New York, and Maine. They are highly associated with ponderosa pine forests that have burned within the past five years or have high bark beetle populations, and which have a high density of pre-burn snags. They also prefer healthy ponderosa pine forests that have dense mature or late successional structure, with a high snag density, preferably clumped (Anderson 2003, Panjabi 2003). This habitat type is especially important when neither recently burned areas or high beetle populations are available. Black-backed woodpeckers excavate nest cavities into a tree's sapwood and often prefer smaller diameter trees than other woodpecker species (Dixon and Saab 2000, Mohren 2002).

Occurrence in and Near the Project Area

The distribution of black-backed woodpeckers is naturally scarce and patchy, in order to take advantage of post-fire habitats. Due to these specific habitat needs, long -term population trends have been generally negative (USDA-Forest Service 2007e). In the Black Hills, Mohren (2002) estimated that approximately 1,200 black-backed woodpeckers occurred in 2000, with an average Forest-wide density of one bird/883 acres (0.28 birds/km2). Densities peaked in 2000, the second year after the Jasper fire (Panjabi 2003). In unburned, uninfected pine habitat of the Black Hills, population density is higher in mature or late successional pine stands with high canopy cover, high tree densities, and high snag densities. Fire exclusion created a more pine dominated, continuously forested landscape. Timber harvest has probably resulted in fewer large-diameter trees, less mortality, and more trees overall.

Black-backed woodpecker populations on the Forest are currently doing well due to the recent fire and insect activity (USDA-Forest Service 2005a). Populations can be expected to decline as these recent fires age. Higher fire-and-insect activities will likely occur over time, separated by periods of low fire-and-insect activity. Black-backed woodpecker populations will likely follow a similar pattern, with populations similar to current levels during periods of high fire-and-insect activity, and dropping during periods of low activity. In the past few years, the habitat trends for the Forest appear to be stable as recently burned areas have regenerated and are maturing and insect caused tree mortality continues to increase (USDA-Forest Service 2007a).

The Project Area contains 5,820 acres of dense and mature, and late successional ponderosa pine habitat suitable to support black-backed woodpeckers. This woodpecker has been identified in the Project Area (USDA-Forest Service 2007c).

Environmental Consequences for Black-Backed Woodpecker

Alternative A (No Action)

This species is dependent on areas of the forest that have recently burned or been infested with pine beetles, and mature and late successional forest with high snag density. The results of Alternative A are likely to be continued development of dense, late successional stands. These stands present an increasing risk of mountain pine beetle infestation and wildfire, which could provide enhanced habitat for black-backed woodpeckers (Dixon and Saab 2000). However, current conditions promote higher intensity wildfire and beetle outbreaks, which could return areas of the forest in which they occur to early successional stages. In the absence of stand replacing fires, Alternative A is likely to increase long-term habitat for this species.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Timber management and prescribed burning activities would affect this species through reduced habitat and removal of nests through tree felling. Dense, mature ponderosa pine habitat suitable for the black-backed woodpecker would be removed by the proposed timber treatments. Treatments would include clearcutting, commercial thinning, commercial hardwood enhancement, overstory removal, pre-commercial thinning and prescribed burning. All snags except those deemed safety hazards would be maintained, thereby assuring a long-term supply of snags.

Clearcuts across 186 acres would have the most severe impact to future snag recruitment by removing large diameter trees. However, the intention of these harvests is to maintain these clearcut areas as meadows, so recovery to a mature stand is not likely or desired.

These alternatives use prescribed burning to treat some stands. This would not be likely to benefit black-backed woodpeckers since prescribed burns do not produce the same mix of post-burn conditions as more intense wildfires. However, there could be increased insect populations invading dead and dying trees after the fires, which are a preferred food source.

New roads and increased off-road travel would present an additional negative impact to black-backed woodpeckers due to increased disturbance of nesting birds and a loss of snags along new road corridors. It is expected that 35 miles of new roads would be built and 126 miles of existing road would be reconstructed under this alternative.

The impacts of timber treatment would be mitigated by Forest Plan Objectives and Standards for general snag protection including the objective to maintain habitat opportunities for black-backed woodpeckers across the Forest, especially as pertains to conifer, snag and recently burned habitat. These standards and objectives are being met through specific design criteria in the alternatives (Appendix B).

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of Alternatives B and C combined with the past, present and reasonably foreseeable future actions would result in a reduction of habitat for black-backed woodpeckers within the Project Area. Fire suppression has resulted in a reduction of post-fire habitat preferred by black-backed woodpeckers. Timber harvest has reduced dense mature forest and large diameter trees. Snag retention standards would mitigate effects of timber harvest and assure a supply of snags. Fire suppression would continue under this and all alternatives and prescribed fires would not provide optimal habitat. Roads would continue to negatively impact black-backed woodpeckers. The cumulative effect of these actions in the Project Area would be a reduction of suitable habitat.

Privately owned lands within and adjacent to the Project Area are likely to provide suitable habitat for this species. Fire hazard reduction activities will probably increase on these lands over the next 20 years in an effort to prevent loss of homes from wildfire. This could continue to decrease black-backed woodpecker habitat. However, the amount of area within these private lands is relatively small compared to the area of National Forest System lands.

Alternatives B and C may adversely impact individuals, but are not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide. As demonstrated in the Annual Black Hills Monitoring and Evaluation Reports, black-backed woodpecker populations on the Black Hills National Forest are currently increasing.

Brown Creeper (*Certhia americana*) - MIS

Brown creepers were chosen as an MIS because of their link to mature and late successional forest coniferous and mixed coniferous-deciduous forests.

Habitat and Range

In the western states, the brown creeper is considered a year-round resident, retreating to lower elevations during the coldest months of winter (Kingery 1998). They prefer mature and late successional ponderosa pine and white spruce (Beason et al. 2006). The brown creeper is found most abundantly in mature, late successional forest coniferous and mixed coniferous-deciduous forests. In the Black Hills, it is largely tied to mature and dense, or late successional pine and white spruce habitats (Panjabi 2005). Dead or decaying trees and snags provide substrate for nests and foraging. Nesting habitat generally contains trees that are larger than nine inches dbh (Hejl et al. 2002). The brown creeper is often observed scaling the bark of trees gleaning spiders, beetles, moths, and other insects from crevices and behind pieces of loose bark (Kingery 1998).

Occurrence in and Near the Project Area

Throughout the Black Hills National Forest, there has been a one percent decline in brown creeper habitat, suggesting that the Forest-wide habitat is relatively stable or slightly decreasing. Forest succession and fire suppression have generally maintained or enhanced habitat for the brown creeper. Snags have most likely increased due to recent fires and insect outbreaks, but amounts have not been quantified.

Management activities within and adjacent to the Project Area have decreased preferred habitat for this species. However, the Project Area does provide the required habitat to support brown creepers including late structural stage ponderosa pine and white spruce. In the Project Area, brown creepers have been observed in untreated forest and in recently thinned stands (USDA-Forest Service 2007a).

Environmental Consequences for Brown Creeper

Alternative A

This species is dependent on late successional pine and white spruce habitat. Assuming a continuation of fire suppression policies, both mature ponderosa pine habitat and white spruce habitat would be expected to increase. The risk of mountain pine beetle infestation and wildfire would also increase, which could return portions of the forest to early successional stages, reducing the amount of habitat available to brown creepers. In the absence of stand replacing fires or beetle outbreaks, habitat available for the brown creeper is expected to increase.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Direct impacts of Alternatives B and C would be a small risk of individual mortality and nest destruction due to tree felling. These alternatives propose treatments in mature, dense coniferous forest, which would reduce potential brown creeper habitat by 3,308 acres. However, the Project Area has an abundance of this type of habitat so there would still be sufficient habitat throughout the Project Area. The brown creeper also prefers spruce habitat, which may be slightly reduced. This could also reduce the area of preferred habitat.

Prescribed burning could have beneficial impacts to this species as a result of increased insect populations after fires and increases in snag habitat (Wiggins 2005, Cerovski 2002).

Habitat fragmentation is also a concern for brown creepers. A literature review by Hejl et al. examining the effects of timber harvesting in the Rocky Mountains (1995) suggested that creepers are less abundant in harvested than unharvested forest types (Hejl et al. 1995). To have viable brown creeper populations, managers need to maintain relatively large patches of uncut forest types across the landscape (Hutto and Young 1999). The proposed actions would be mitigated by Forest Plan Objective 238 that would strive to maintain or enhance habitat for this species. Assuming this Objective is met, suitable habitat should be maintained for the species.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of Alternatives B and C combined with the past, present and reasonably foreseeable future actions would result in a reduction of habitat for brown creepers within the Project Area. Fire suppression has generally increased or maintained available habitat while management activities have

decreased habitat. The cumulative effect of these actions would be a reduction of mature, dense coniferous forest. Forest Plan standards would provide snags that would reduce this effect.

Private land within and adjacent to the Project Area may also provide suitable habitat. Private landowners could treat forests for lumber or to reduce fire hazards, which could reduce habitat for brown creepers if late successional pine and spruce stands are treated. This would likely increase the importance of habitat located on NFS lands.

Flammulated Owl (*Otus flammeolus*) - Sensitive Species

The flammulated owl was selected as a Sensitive Species because of its dependence on mature and late successional forest ponderosa pine habitat, a habitat that has declined due to timber harvest and fires in the past 200 years (USDA-Forest Service 2007e).

Habitat and Range

The flammulated owl breeds in mountain ranges from Central America north through the western US to southern British Columbia; it winters from Mexico into Central America (Johnsgard 1988; Sibley 2000). In the United States and Canada, it lives in montane forest habitats dominated by mature, open ponderosa pine. Flammulated owls select older successional stages for breeding and nesting (Hayward and Verner 1994). They nest in secondary cavities, depending upon flickers and other woodpeckers for cavity excavation (Ehrlich et al. 1988, Hayward and Verner 1994). Nest cavities occur in large snags (Hayward and Verner 1994), which are rare in the Black Hills.

Interior and exterior forest edge seems to be a desirable if not necessary component of flammulated owl foraging habitat (Hayward and Verner 1994). Clumped tree distributions, multi-layered canopy with low-to moderate cover, and a well-developed shrub component are habitat characteristics (Hayward and Verner 1994). Relatively open, multi-layered habitats with considerable edge may not only maximize prey density but also accommodate the foraging strategies used by this owl (Hayward and Verner 1994). The species is almost entirely insectivorous, capturing insects on the ground, on vegetation, and in flight (Ehrlich et al. 1988).

Occurrence in and Near the Project Area

The population trend for the flammulated owl throughout Region 2 is not known due to a lack of evidence. Until recently, the flammulated owl was thought to be absent from the Black Hills. In their range-wide assessment of the owl, Hayward and Verner (1994) specifically noted that the species was not present in the Black Hills despite the availability of seemingly suitable ponderosa pine habitat. However, there have been two reports of flammulated owls in the Black Hills in the past 10 years. These could represent periodic use by transient individuals or the beginning of a range expansion. Establishment of flammulated owls in newly occupied habitat could take many years, because the species has a low reproductive potential (Hayward and Verner 1994). A concerted effort was made to verify flammulated owls at the two recent observation areas and other seemingly suitable sites during 2003, but the species was not detected (Fauna West Wildlife Consultants 2003).

The ponderosa pine structural stages corresponding most closely to potential flammulated owl nesting and foraging habitat on the Forest are mature successional stage stands with canopy cover less than 70 percent, and

less dense late successional stands. Currently, 57 percent (594,000 acres) of the Forest and 49 percent (20,218 acres) of the Project Area contain these structural stages. An additional 615 acres of late successional stands may provide habitat. Roosting habits are unknown in the Black Hills, but if range-wide patterns hold true here, the species may roost in spruce or in stands where pine and spruce co-occur. Current trends indicate that spruce habitat is increasing across the forest.

Flammulated owls have not been observed in the Project Area, but both known occurrences of the species in the Black Hills were approximately 2 miles south of the Project Area.

Environmental Consequences for Flammulated Owl

Alternative A

This alternative would continue current fire suppression policies, maintaining forest succession and leading to an increase in later successional stage stands. Snags are expected to increase with increased forest density. However, the risk of high intensity wildfire and mountain pine beetle outbreaks would also continue to increase with this alternative, both of which could return areas of the forest to early successional stages. In the absence of stand replacing fire or insect outbreaks, habitat for this species is expected to increase. Only two flammulated owls have been documented on the forest and none in the Project Area, therefore the impact to this species would be minimal.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

The flammulated owl appears to be a habitat specialist with low fertility (small clutch size), which is generally an adaptation to a stable environment (Hayward and Verner 1994). This implies that this owl would be sensitive to habitat modification. Direct effects to the flammulated owl include limited potential individual mortality due to tree felling.

Indirect impacts may occur due to changes in mature and late successional forest habitat. Mature successional stage stands with less than 40 percent canopy cover are expected to increase in MAs 4.1, 5.1, and 5 .6, but decrease slightly in MA 5.4. The decrease would be caused by clearcut harvests that would convert these areas to the grass/forb successional stage. Mature successional stage stands with canopy cover between 40 to 70 percent canopy cover would decrease in all MAs. Late successional stage stands are expected to remain stable or slightly decrease in all MAs.

Additional suitable habitat for the flammulated owl exists in white spruce stands. The area of mature white spruce would be reduced slightly, particularly in ecotones where pine and spruce come together. Spruce dominated stands would be protected if Project Area design criteria are followed. Late successional white spruce habitat would not be affected by this alternative. Changes in the distribution and size of snags (potential nest trees) could also be important. There could be some reductions to snags due to timber harvest and prescribed fire. The effects of management activities on snags would be mitigated by Forest Plan snag objectives (USDA-Forest Service 2006a).

As only two sightings of this species have been recorded on the Forest, none of the alternatives are expected to have impacts on species viability, nor cause a trend towards federal listing or a loss of species viability range wide. Due to lack of this species in the Project Area, effects should be minimal for all alternatives.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of Alternatives B and C combined with the past, present and reasonably foreseeable future actions would result in a slight reduction in mature and late successional forest habitat for flammulated owls within the Project Area. Forest Plan standards would provide snags that would reduce this effect. At present, there is no evidence suggesting that flammulated owls are established or breeding in the Black Hills. Therefore, Forest management would presumably have little influence in the Black Hills since the species does not appear well established here.

Privately owned lands within and adjacent to the Project Area may also provide suitable habitat. Fire hazard reduction activities are likely to occur on some of these lands in an effort to prevent loss of homes from wildfire. This could decrease owl habitat should mature and late successional forest habitat be reduced. However, the amount of area within these private lands is relatively small compared to what is on the Forest. It is assumed that urban development would continue on private lands. This would likely increase the importance of habitat located on NFS lands.

The changes described under direct and indirect effects for any alternative could affect the individual owls on the Forest. However, there would likely be little impact on the number, reproduction, or survival of flammulated owls. This is because a large amount of currently unoccupied but suitable habitat would still be available for owl colonization. Furthermore, the low reproductive output of flammulated owls would necessitate many years of breeding before the habitat became fully occupied.

Golden-Crowned Kinglet *(Regulus satrapa)* - MIS

Golden-crowned kinglets were selected as an MIS to evaluate the effects on species that rely on a variety of conditions in spruce habitat. It may be intolerant to changes on nesting grounds (USDA-Forest Service 1981).

Habitat and Range

In the Black Hills, the golden-crowned kinglet is closely associated with white spruce, breeding almost exclusively in white spruce habitat (Beason et al. 2006). The golden-crowned kinglet is an uncommon permanent resident at higher elevations in the Black Hills, where they are found primarily in white spruce forests (Panjabi 2003). Golden-crowned kinglets are uncommon in winter in the Black Hills, but are common spring and fall migrants.

Occurrence in and Near the Project Area

Data for golden-crowned kinglets indicate that the species occurs primarily in the northern half of the Black Hills and is moderately abundant in spruce habitat (Panjabi 2001, 2003, 2004, Beason et al. 2006, USDA-Forest Service 2006). Over the past five years the population of golden-crowned kinglet appears to be increasing, based on the short- and long-term increases in spruce. The Project Area contains approximately 3,939 acres of suitable habitat for this species.

Environmental Consequences for Golden-Crowned Kinglet

Alternative A

This species relies on white spruce habitat in the Forest. This alternative would continue fire suppression policies and would be expected to maintain the trend of limited white spruce expansion into wet forest areas and aspen habitat. As a result, this alternative should lead to a long-term increase in available habitat for the golden-crowned kinglet.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Alternatives B and C would have a low potential for direct impacts, including individual mortality and nest destruction due to tree felling. Management activities that reduce spruce habitat could indirectly impact this species. These alternatives would slightly reduce the area of white spruce, particularly in ecotones where pine and spruce come together. Spruce dominated stands would be protected in the Project Area by design criteria.

White spruce on the Black Hills is naturally distributed as patches at low abundance and there are gaps where spruce habitat is absent or only present in low abundance (USDA-Forest Service 2005a). Kinglets are mobile, and disjunct areas of spruce habitat are typically large enough and close enough to permit dispersal and interaction among subpopulations across the Forest. Breeding densities are known to decline in burned and logged areas, habitats with open canopies, and hardwood forests (NatureServe 2006). Potential effects to these areas would be mitigated by following Standard 2301.

These alternatives also provide design criteria to protect 751 acres of marten corridors, which are spruce dominated habitat. These criteria would also benefit golden-crowned kinglets. The identified and protected marten corridor habitat in the Project Area includes some of the best and most contiguous spruce habitat on the Forest.

Alternatives B (Proposed Action) and C - Cumulative Effects

Alternatives B and C would have little effect on spruce forests and would not likely cause a decline in habitat for this species. Therefore, the golden-crowned kinglet population is likely to remain stable.

There are approximately 25,000 acres of white spruce across the Forest. Habitat of this type is likely to remain except for under unique circumstances (e.g., WUI, aspen enhancement, etc.). Fire suppression has allowed an increase of spruce in certain habitats in the Forest (USDA-Forest Service 2005a). While the proposed activities would slightly reduce spruce in dry sites or in pine-spruce ecotones, there are no large scale efforts to reduce spruce stands.

Privately owned lands could also provide suitable breeding and winter habitat for the golden-crowned kinglet. Landowners could treat forests for lumber or to reduce fire hazard, which could reduce habitat for golden-crowned kinglets if late successional spruce stands are treated. This would likely increase the importance of habitat located on NFS land.

These alternatives are expected to allow the golden-crowned kinglet population to remain stable. The action alternatives would have little effect on spruce forests and are not likely to cause a decline in habitat for this species.

Lewis's Woodpecker (*Melanerpes lewis*) - Sensitive Species

This species was selected as a Sensitive Species due to declines in large-diameter standing snags, late-successional forests, and mature lowland riparian cottonwood forests.

Habitat and Range

In South Dakota, Lewis's woodpecker is considered a locally uncommon summer resident in the Black Hills and a locally rare yearlong resident of adjacent stream bottoms (South Dakota Ornithologist's Union 1991). The Lewis's woodpecker is partially migratory, with migration routes and wintering areas varying among years and locations (Anderson 2003). There is no information on migration patterns or wintering areas in the Black Hills.

The species is an edge specialist that prefers open mature pine forests, mature riparian cottonwood and oak forests, and coniferous forest with large burned trees (Tobalske 1997). They also prefer open, park-like ponderosa pine forests (Anderson 2003; Panjabi 2003). Lewis's woodpeckers typically excavate nest cavities in soft ponderosa pine or cottonwood snags, although they will also re-use cavities made by other woodpecker species. They nest in large snags (Anderson 2003). Lewis's woodpeckers prey on flying insects by flycatching or sailing from a perch (Tobalske 1997). They also forage for mast (e.g., acorns and berries), which they often store in bark crevices.

Occurrence in and Near the Project Area

In the Black Hills, this woodpecker is most often observed in burned pine forests, but it could also be found in mature to late-successional ponderosa pine stands that have an open canopy and burned areas with large soft snags. Breeding has been documented in the Black Hills by Peterson (1995) and Vierling (2004). Panjabi (2001, 2003, and 2004) considered Lewis's woodpecker to be rare in the Black Hills, with three individuals observed in 2001, four in 2002, and nine in 2003.

Locally, data suggests that many populations of Lewis's woodpeckers may have declined since the 1960s (Sauer et al. 2008; Tobalske 1997). However, due to the sporadic distribution and cyclical abundance of this species, these data may not adequately sample populations and many estimates lack statistical significance (Sauer et al. 2008).

Open, mature or late successional stage ponderosa stands most closely resemble the preferred nesting, foraging, and roosting habitat for the Lewis's woodpecker. In the Project Area, there are approximately 4,500 acres of this type of habitat. Riparian areas tend to be dominated by paper birch, aspen, and willow rather than cottonwood and, therefore, do not provide existing habitat. Risks to Lewis's woodpeckers include activities that reduce open or old-growth ponderosa pine forests and snags (e.g., fire suppression and clearcutting) (Anderson 2003).

The Project Area contains suitable habitat in open, mature ponderosa pine forests. Although the Project Area provides habitat, this species has not been documented in the Project Area.

Environmental Consequences for Lewis's Woodpecker

Alternative A

This species depends upon open mature or late successional forests (mature successional stage with less than 40 percent canopy cover and some late successional stands) with available snags. Under this alternative, snag availability would likely increase and should not be a limiting factor. Continued forest succession would likely lead to a reduction in open mature stands. There are increased risks from high intensity wildfire and mountain pine beetle outbreaks with this alternative, which could return areas of the forest in which they occur to early successional stages. In the absence of stand replacing fire, available habitat for this species is likely to decrease.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Direct effects to Lewis's woodpecker include the limited potential for individual mortality due to tree felling. Indirect effects include long-term increases in preferred habitat in open, late- successional pine stands. Alternatives B and C would provide an increase in habitat of approximately 8,039 acres in the Project Area. Changes in the distribution and size of snags (potential nest trees) could also be important. These alternatives may slightly reduce snags due to timber harvest and prescribed fire. The effects on snags would be mitigated by Forest Plan Standard 2301. These standards are met through the use of specific design criteria (Appendix B).

Alternatives B and C may adversely impact individuals, but are not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide. These alternatives provide long-term additional habitat for this species in the Project Area due to an increase in open forest areas.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of Alternatives B and C combined with the past, present and reasonably foreseeable future actions would result in a minor increase in habitat for Lewis's woodpecker within the Project Area resulting in stable or increasing populations of Lewis's woodpecker. Forest Plan standards would provide snags that also increase suitable habitat.

Privately owned forestlands within and adjacent to the Project Area also provide potential nesting and foraging habitat. Landowners may treat forests for lumber or to reduce fire hazard, which could create habitat if mature stands with closed canopies are opened up. It is uncertain how this would result in changes in placement of or levels of treatments in Lewis's woodpecker habitat and how effects would be expected to change.

Loggerhead Shrike (*Lanius ludovicianus*) - Sensitive Species

This species was selected as a Sensitive Species due to concerns about range-wide declines over the past century (USDA-Forest Service 2007e).

Habitat and Range

The loggerhead shrike is a fairly common summer resident in South Dakota, with breeding records occurring over most of the state (Luce et al. 1999, Tallman et al. 2002, Peterson 1995). This species is associated with

open habitats that include scattered or clustered shrubs or trees. This includes some types of grasslands, shrublands, and savannas. The optimal habitat for this species is open grasslands habitats with scattered pine trees for perching. Nesting habitat includes mixed-grass prairies with brush or trees for courtship and nesting. Foraging habitat includes areas of open, short vegetation with some bare areas and thorny trees or barbed-wire fence for impaling prey (Wiggins 2005). These habitats are limited in the Black Hills but are provided mainly by mixed-grass prairies, mountain mahogany shrublands, and grassy or brushy areas with scattered juniper or ponderosa pine. Scattered pines may be particularly important, as the birds hunt over grasslands and require occasional perch sites and nests in shrubs or trees (Nicholoff 2003, Terres 1991). The shrike's diet consists of insects, small birds and mammals, reptiles, and amphibians (Terres 1991). They are the only songbird that regularly preys on other vertebrates (Terres 1991).

Occurrence in and Near the Project Area

Breeding records for the species occur near the periphery of the Black Hills but not in the interior or at higher elevations (Peterson 1995). This species has shown declines in population nearly range-wide (Sauer et al. 2008). Factors that affect loggerhead shrike populations include shrub conversion for increased livestock forage, wildfires in arid shrublands, insect (particularly grasshopper) control programs, and grazing pressure in arid shrub communities (Beidleman 2000). Additional potential threats to the species include agricultural conversion, degradation or loss of nesting trees and shrubs, and over-grazing (Wiggins 2005).

In the Black Hills, suitable habitat is mainly found in the southwestern portion of the Black Hills of the area. Most of the interior Black Hills do not provide suitable habitat because tree density is too high. Two loggerhead shrikes were recorded in 2001 during bird monitoring efforts (Panjabi 2004). None were detected in 2002 and 2003 during similar efforts.

The Project Area contains some grass and shrub habitat that may support this species. The smaller size of many of these habitat patches, however, may limit their suitability. One loggerhead shrike has been recorded in the Project Area according to the West Rim fauna database.

Environmental Consequences for Loggerhead Shrike

Alternative A

Alternative A would see a continuing decline in the scattered meadows and openings as pine encroachment continues. This alternative increases the risk of high intensity wildfire and mountain pine beetle outbreaks, which could return areas of the forest to early successional stages, increasing available habitat. In the absence of these types of events, habitat for the species is expected to decline under this alternative.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Direct effects to this species would be limited and include a potential for individual mortality during meadow enhancement activities. Treatments in meadows or other interior habitats would have minimal impact on the species since these areas do not provide optimal shrike habitat. Meadow enhancement treatments could cause a decrease in shrike habitat if scattered pines are removed from grasslands that potentially serve as shrike habitat.

Alternatives B and C propose post-treatment or broadcast burning on 13,226. Direct effects of burning would be mitigated by Forest Plan standards that mandate that no more than 60 percent of any contiguous grassland be burned at any one time, and directs burning to occur during early spring or fall. This standard is incorporated into these alternatives, decreasing the risk that fire would be applied in all suitable shrike habitats at any one time, and helping to provide a mosaic of vegetative conditions. It would also decrease the chance that nests would be impacted by fire.

Alternatives B and C may adversely impact individuals, but are not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide. Due to the lack of suitable habitat in the Project Area, impacts of these alternatives should be minimal.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of Alternatives B and C combined with the past, present and reasonably foreseeable future actions would result in no overall change in habitat for loggerhead shrike within the Project Area. Changes in the Project Area are not likely to have impacts on populations due to the limited suitable habitat contained within the Project Area.

Privately owned lands within and adjacent to the Project Area also provide potential habitat, although it is difficult to predict trends on these lands.

Northern Goshawk (*Accipiter gentilis*) - Sensitive Species

The species was selected as a Sensitive Species due to concerns that timber programs, fragmentation of habitat, and increasing human activity may threaten goshawk habitat (USDA-Forest Service 2007e).

Habitat and Range

In South Dakota, this forest raptor is a rare to uncommon permanent resident, especially in the higher elevations of the Black Hills (South Dakota Ornithologist's Union 1991). Known nest densities are generally higher in the northern and central hills (USDA-Forest Service 2001a). Limited information suggests that the goshawk is a partial migrant, usually moving less than 300 miles (Kennedy 2003). Juveniles are also known to disperse up to 100 miles from their natal nest area (Kennedy 2003).

At least 40 percent of a goshawk's home range needs to include mature or late-successional stands with greater than 40-to-50 percent canopy closure. Home ranges have been found to average 6,000 acres (Reynolds et al. 1992). Post-fledging family and foraging areas typically include a diversity of forest types and conditions including stands of young, mid-aged, mature, and late-successional trees (Reynolds et al. 1992). Prey varies but may include red squirrels, least chipmunk, rabbits, robins, juncos and northern flying squirrels (Erickson 1987). Snags, downed logs, and woody debris are an additional important component of the post-fledging family and foraging habitat.

Typical nest areas for goshawks in the northern Rocky Mountains are dense, mature or late-successional, coniferous forest, with high canopy closure, clear forest floors, on north-facing moderate slopes (Hayward and Escano 1989; Squires and Ruggiero 1996). Goshawks tend to select stands that have relatively large trees and relatively high canopy closure (Kennedy 2003). In the Black Hills, the goshawk nests in mature, dense, or

moderately dense stands of large diameter pine (USDA-Forest Service 2001a) with canopy closure greater than 50 percent (Reynolds et al. 1992).

Occurrence in and Near the Project Area

Goshawks are difficult to monitor because of their secretive nature and use of alternate nests. On the Forest, known nests are monitored for nesting activity. There are 90 known goshawk territories on the Forest, of which nine (26 percent) were active in 2005 monitoring (USDA-Forest Service 2006a). This territory occupancy rate is consistent with other data. Goshawk territoriality and nest attempts show high annual variation and may be tied to annual precipitation fluxes that affect prey abundance. Therefore, drought conditions over the past several years may be affecting goshawks.

Suitable goshawk habitat has also been analyzed for the Forest. Suitable nesting habitat exists on approximately 136,000 acres. These areas are found in stands of ponderosa pine that are in a mature successional stage with greater than 70 percent canopy or in late successional stands. An area of 302,676 acres of mature ponderosa pine with 40 to 70 percent canopy cover may provide nesting habitat. Recent fires have likely created abundant habitat for some goshawk prey species such as woodpeckers but also have reduced nesting and foraging habitat for goshawks, including destroying some nests. Wildfires would continue to burn in the future and have a cumulative effect along with planned management actions.

In the Project Area, there are approximately 5,820 acres of suitable ponderosa pine nesting habitat and an additional 15,031 acres possible habitat in less dense stands. The Project Area includes three historical goshawk territories. Once identified, it was determined that deferring treatment would be most beneficial to goshawks. The following territories occur within or partially within the Project Area:

- Clayton Territory
    - -Nest surveys were conducted 1997, 1998, 2000, 2001, 2003, and 2007.
    - -Last confirmed active nest in 2000.
    - -Last confirmed goshawk observation in 2002.
- Elmer Territory
    - -Nest surveys were conducted 1988, 1995, 1997-1999, 2000, and 2006-2007.
    - -Last confirmed active nest in 1999.
    - -Last confirmed goshawk observation in 2007.
- Iron Creek Territory:
    - -Nest surveys were conducted in 1994, 1997-2003, and 2007.
    - -Last confirmed active nest and goshawk observation in 1994.

Environmental Consequences for Northern Goshawk

Alternative A

Alternative A would continue current patterns of forest succession, leading to an increase in forest density. Northern goshawks require mature and dense forest areas at least 50 acres in size for nesting habitat. Over time, some stands would become too dense for nesting while others would mature to provide optimal nesting conditions (Greenwald et al. 2005). Foraging habitat is more varied and may include openings, forest edges and open canopy stands. Some open foraging habitat may decrease as forest openings are reduced due to pine encroachment. The risk of high intensity fire increases with this alternative. Stand replacing fire has the potential to destroy nest trees and other habitat areas. Overall, in the absence of stand-replacing fire, this alternative is likely to increase nesting habitat, but the diversity of foraging habitat would decrease.

Alternative B (Proposed Action) - Direct and Indirect Effects

Direct impacts from Alternative B to northern goshawks include a limited potential for loss of unknown active nests due to tree felling or prescribed fire. There would be no direct impacts to known nests, because treatments are not proposed within the three identified nest areas. There would be some treatments within one-half mile of active and historical nest sites. These include; 673 acres near the Clayton territory, 947 acres near the Elmer territory and 741 acres near the Iron Creek territory. Treatments in these areas would include commercial thinning, prescribed burning, and overstory removal followed by pre-commercial thinning.

Overstory removal and thinning may reduce the suitability of some adjacent habitat for foraging, post-fledging family area (PFFA) or for future nesting opportunities. Disturbance to nesting goshawks would be minimized by Forest Plan Standard 3111, which includes a seasonal timing restriction (April 1 to August 15) within one-half mile of active nests. This is consistent with US Fish and Wildlife Service guidelines.

Prescribed fire in habitat adjacent to nest areas may improve foraging habitat for goshawks by opening up dense understory vegetation, creating snags, downed logs, woody debris, and other conditions that may benefit goshawks and their prey. However, prescribed fire could also have temporary negative impacts to goshawks by reducing available down woody debris and causing disturbance to nesting birds. To minimize impacts associated with human disturbance and smoke inhalation, Standard 3111 would apply to all prescribed burns that are within one-half mile of active nest sites.

Impacts to known nests would be mitigated by Forest Plan Standards and Project Area design criteria (Appendix B). Forest Plan Standards provide species-specific direction for conservation of active and historically active goshawk nest sites and territories. Nest areas are defined (and have been identified in the Project Area) as 180 acres of the best-suited nesting habitat within one- half mile of the nest and greater than 300 feet from buildings (to allow for defensible space for fires). Activities within these stands are limited to those that maintain or enhance the stands' value for goshawks. In the Project Area, no treatments were proposed within the identified goshawk nest areas because it was determined that silvicultural treatments would not enhance the habitat. Prescribed fire in these locations would be difficult and risky without first thinning the understory vegetation. No prescribed fire within these areas was proposed.

Long-term indirect effects include a reduction in potential goshawk habitat. Moderately dense mature and late successional forest habitat contributes to nesting and foraging habitat. This alternative would reduce dense, mature stands by approximately 12,292 acres in the Project Area. Late successional habitats would remain stable or slightly decrease for all MAs, with an overall reduction of 56 acres.

Even though goshawks are not a cavity dependent species, they prey on cavity nesters that use snags. Under this alternative, some snags may be lost during management activities. This loss would be mitigated by the Forest Plan objectives and standards specific to snag preservation.

Forest-wide structural stage objectives provide nesting and foraging habitat across the Forest, but it is unclear whether every Post Fledgling Family Area would meet ideal habitat conditions. Fragmentation of forested habitats may make areas more suitable for other raptors and increase competition (Kennedy 2003), but the relationship and threshold are unclear.

Alternative B may adversely impact individuals, but is not likely to result in loss of viability in the Project Area, nor cause a trend towards federal listing or loss of species viability range wide.

Alternative B (Proposed Action) - Cumulative Effects

The direct and indirect effects of Alternative B combined with the past, present and reasonably foreseeable future actions could decrease potential nesting habitat for the northern goshawk within the Project Area.

Privately owned land within and adjacent to the Project Area may provide nesting habitat. However, private landowners may harvest timber or treat forested lands to reduce fire hazard, which could reduce goshawk nesting habitat if mature forests are reduced. It is assumed that urban development would continue on private lands. This would likely increase the need to provide defensible space around structures and could reduce goshawk nest and foraging habitat and increase the importance of habitat located on NFS lands.

It is foreseeable that more communities could be designated as at-risk communities with fuel reduction activities potentially occurring around them. It is uncertain how this would result in changes in placement of or levels of treatments around goshawk nests and how effects would be expected to change.

Alternative C - Direct and Indirect Effects

None of the three nest areas in the Project Area overlap with the additional treatments in Alternative C. However, the Iron Creek and Elmer nesting areas are within ½ mile of additional treatment areas. Within ½ mile of the Elmer area, four WUI structure buffer treatments (for a total of 50 acres) and one additional treatment area of 65 acres are proposed. The Iron Creek nesting area is within ½ mile of six WUI treatment areas for a total 36 acres of treatment. Treatments in these areas would be limited to thinning and removal of conifers nine inches dhb or less, limbing trees up to 15 feet and piling/burning of woody material. These activities are not expected to negatively affect nesting territories. Foraging habitat is not expected to be affected by Alternative C, as the size of a goshawk territory is such that a diversity of foraging habitat can be provided in other parts of the Forest. Additionally, timing restrictions (see Appendix B - Design Criteria) would restrict activities during nesting season in the nest areas.

Alternative C may adversely impact individuals, but is not likely to result in a loss of viability in the Project Area nor cause a trend towards federal listing or loss of species viability range wide.

Alternative C - Cumulative Effects

Cumulative impacts would be the same as discussed under Alternative B, with the added impact of additional treatments under Alternative C near the Elmer and Iron Creek territories.

Ruffed Grouse (*Bonasa umbellus*) - MIS

The ruffed grouse was selected as an MIS to evaluate the effects of Forest Plan implementation on species that rely on a variety of conditions in aspen to meet their needs.

Habitat and Range

The ruffed grouse is a year-round resident in the Black Hills, occurring widely but in low abundance (Panjabi 2003). It nests in forests or woodlands with some deciduous trees and is closely associated with hardwoods; particularly aspen (McCaffery et al. 1997). This species feeds on aspen buds in the winter and catkins in the spring (USDA-Forest Service 1996a). Ruffed grouse may require a variety of aspen structural stages to thrive, including mature aspen for drumming logs and most other stages for buds and catkins.

Occurrence in and Near the Project Area

Data suggest the ruffed grouse occurs widely throughout the northern Black Hills (Panjabi 2001, 2003, 2004). The greatest impact to ruffed grouse has been loss of healthy aspen stands due to fire suppression and forest succession. Historic fire suppression has resulted in reduced vigor of existing aspen stands and inhibited regeneration (Parrish et al. 1996). Also, expanding ponderosa pine stands have reduced the amount of aspen as an understory component. These habitat changes have reduced the amount of optimum habitat available for ruffed grouse.

The Project Area contains suitable habitat for the ruffed grouse and numerous ruffed grouse have been observed (USDA-Forest Service 2007b). There are 3,102 acres of available aspen habitat.

Environmental Consequences for Ruffed Grouse

Alternative A

The ruffed grouse depends on aspen habitat with a variety of structural stages. Alternative A would likely result in increased aspen encroachment by ponderosa pine and white spruce. Healthy aspen stands have already been limited by fire suppression and forest succession. This trend would continue, leading to continued reduction in available grouse habitat.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Alternatives B and C pose a low potential of individual mortality and nest destruction due to tree felling. Some habitat could be temporarily disturbed due to commercial and non-commercial hardwood treatments across 1,034 acres. Long-term impacts would be a positive increase in habitat. Hardwood enhancement treatments would create 525 additional acres of suitable aspen habitat. Activities that remove pine encroachment, within and along aspen stands, help to maintain the stands as aspen and promote regeneration. These young aspen

stands are ideal habitat for the ruffed grouse (Gullion 1989). Prescribed fire could also lead to a long term increase in aspen and ruffed grouse habitat. Aspen are less flammable than conifers and fires can stimulate new growth. Prescribed fire is proposed across 2,857 acres of the Project Area.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of Alternatives B and C, combined with the past, present and reasonably foreseeable future actions, would increase aspen habitat, potentially leading to an increase of ruffed grouse populations. Privately owned land also provides potential nesting, brood, and drumming habitat. Although landowners could treat aspen, which could reduce habitat for ruffed grouse, aspen is often seen by landowners as a desirable species. If hardwood restoration treatments are successful, long-term populations should remain stable or increase.

Song Sparrow (*Melospiza melodia*) - MIS

The song sparrow was selected as an MIS to evaluate the effects of Forest Plan implementation and natural change on the ability of the forest to support characteristic riparian species.

Habitat and Range

In the Black Hills, the song sparrow is strongly associated with riparian and wetland habitats, particularly streamside thickets (Panjabi 2001). They are uncommon winter residents in the Black Hills, likely spending the winter on adjacent prairie habitat.

Occurrence in and Near the Project Area

Song sparrows occur throughout much of the Black Hills, although they appear to be more abundant and widespread in the north (Panjabi 2001, 2003). Long-term population trends are unknown. Riparian habitats in the Forest have degraded in quality and decreased in quantity over the past 100 years due to human activities and fire suppression. These activities have most likely caused long-term declines of optimal habitat and song sparrow populations.

Short-term trends indicate stable to increasing populations. Montane riparian habitats show relatively stable song sparrow densities since 2003, with small increases (USDA-Forest Service 2007a). Breeding Bird Survey data show that song sparrow populations were stable to slightly increasing in the Black Hills in recent years (Sauer at al. 2003).

The Project Area contains suitable habitat to support the song sparrow. Riparian habitat is present on Spearfish Creek and its tributaries.

Environmental Consequences for Song Sparrow

Alternative A

Song sparrows rely on riparian habitat. Alternative A would not enhance riparian areas. Aspen, oak and cottonwood habitat may be reduced due to pine encroachment. Long term, habitat for the song sparrow would be expected to decline.

Alternative B (Proposed Action) - Direct and Indirect Effects

Management activities proposed in Alternative B in riparian areas could impact the song sparrow**.** Direct effects would include a low potential for individual mortality due to tree felling and prescribed burning. Fuel treatments are proposed to remove small diameter conifers from hardwoods in the Spearfish Creek riparian area. These treatments may enhance aspen, oak and cottonwood stands and would avoid climax birch stands.

New roads and road maintenance activities are proposed in areas of proposed timber harvest. These activities would require additional stream crossings, which have the potential to negatively impact riparian habitat. Negative impacts to riparian areas would be minimized through Best Management Practices (BMPs), Watershed Conservation Practices (WCPs) and other Forest directives, and through identified design criteria.

Alternative B would not restore riparian areas; however, they would maintain or enhance riparian hardwood communities. Long term, sparrow habitat could increase due to an expansion of willow, aspen and birch near riparian areas (USDA-Forest Service 2005c). Moving toward the riparian objectives Forest-wide, would create adequate habitat for maintaining song sparrow populations across the Forest.

Alternative B (Proposed Action) - Cumulative Effects

The direct and indirect effects of Alternative B combined with the past, present and reasonably foreseeable future actions would maintain or enhance song sparrow habitat in the Project Area. Riparian habitat within and adjacent to the Project Area has previously been impacted by human activities such as overuse of livestock, mineral withdrawal and road crossings. Forest Plan Guideline 3212 should reduce these impacts on riparian areas in the future. The risk of high intensity wildfire would be decreased; therefore this alternative would have a lower risk of increased sediment yield to creeks and loss of riparian shrubs.

Privately owned land within and adjacent to the Project Area could also provide suitable breeding and migration stopover habitat for the song sparrow. However, wetland and riparian habitat on private lands may not be afforded the same level of conservation management as on NFS lands.

Alternative C - Direct and Indirect Effects

Alternative C proposes treatments along creeks, seeps and springs in Spearfish Canyon. Removal of understory trees within riparian areas may decrease total available habitat for the song sparrow. In addition, the proposed treatments may spread invasive weeds on disturbed sites, further reducing the quality of riparian habitat available for this species. Depending on the amount of removal, and resulting disturbance, this could fragment existing habitat.

However, while up to 1,396 acres of NFS lands in Spearfish Canyon would be treated to reduce fuel hazards, this represents less than one percent of lands within the Project Area. Since the song sparrow population on the Forest is relatively stable and assuming movement is made toward riparian objectives Forest-wide, there would be adequate habitat for maintaining song sparrow populations across the Forest.

Alternative C - Cumulative Effects

Cumulative impacts would be the same as discussed under Alternative B, with the added impact of additional treatments under Alternative C.

American Marten (*Martes americana*) - Sensitive Species

The marten was selected as a Sensitive Species due to concerns about fragmentation of habitat from development and the natural patchiness of suitable habitat (USDA-Forest Service 2007e). The main threats to American martens are habitat fragmentation and timber harvest (Buskirk 2002). Small isolated populations, such as are found in the Black Hills, are vulnerable to extinction from lack of genetic variation, disease, and catastrophic events (e.g., stand-replacing fires) (Buskirk 2002).

Habitat and Range

The American marten is distributed over much of the western United States, occurring in moist boreal forests (Buskirk 2002). In the Black Hills, marten habitat is dense, mature and old-growth stands dominated by spruce, with canopy closure greater than 50 percent (Fredrickson 1989, Fecske et al. 2003). Key habitat elements are relatively dense forests with complex physical structure near the ground, abundant coarse woody debris, and lengthy fire-return intervals (Buskirk 2002). Large logs and other structures provide protective thermal conditions and protection from predators (Buskirk and Powell 1994). A variety of structures are used for dens, with trees, snags, logs, and rocks accounting for 70 percent of reported den structures (Buskirk and Ruggiero 1994).

Important prey species in the Black Hills are the southern red-backed vole (*Clethrionomys gapperi*), red squirrel (*Tamiasciurus hudsonicus*), and northern flying squirrel (*Glaucomys sabrinus*) (Buskirk 2002). Marten will also eat carrion, bird eggs, insects, and fruit (Buskirk and Ruggiero 1994). Marten breed from June to August, and after delayed implantation, give birth the following April and May to a litter of three (Buskirk 2002).

Occurrence in and Near the Project Area

American marten were reintroduced into the Black Hills during the 1980s and 1990s (Buskirk 2002). Fecske et al. (2003) recently estimated that 124 resident martens occur in high quality habitat, with additional animals occurring at lower density within lower quality habitat. The greatest marten concentrations appear to be in the northern part of the Forest and in and around the Norbeck Wildlife Preserve in the central Hills (Fecske et al. 2003). The northern subpopulation of martens occupies the southern end of the Project Area, and western third of the Telegraph Planning Area (an adjacent planning area to be analyzed in 2008), where climax spruce habitat dominates the landscape.

Although considerable mortality and reproduction have likely occurred here since reestablishment began, it appears the marten population trend is relatively stable in the Black Hills (USDA-Forest Service 2004). Spruce habitat appears to be increasing in the forest, suggesting that marten habitat may be increasing. Marten typically avoid dry ponderosa-pine sites; however, due to the limited distribution of spruce in the Black Hills, most marten territories undoubtedly contain some portion of pine (Buskirk 2002). Mature and late-successional pine stands also help maintain connectivity between spruce stands. Martens are sensitive to habitat fragmentation and will not move through large, non-forested areas.

There are 3,939 acres of white spruce habitat in the Project Area. Habitat and travel corridors have been identified based on habitat suitability. Marten have been observed in the Project Area, primarily where climax spruce habitat dominates the landscape.

Environmental Consequences for American Marten

Alternative A

The American marten depends on dense mature and late successional stands with woody debris and greater than 50 percent cover. White spruce is the preferred habitat, but movement corridors include mature and late successional ponderosa pine forest as well. Alternative A would allow forest succession to continue; increasing canopy cover and forest density, and expanding white spruce in some stands. These trends would likely benefit marten by increasing denning and foraging habitat. Prey associated with closed forest conditions is also likely to increase. However, the risk of high intensity fire and pine beetle outbreaks increases with this alternative. If stand replacing fire or beetle outbreaks occur, some optimal habitat may be destroyed. In the absence of stand replacing events, habitat for marten is likely to increase under this alternative.

Alternative B (Proposed Action) - Direct and Indirect Effects

Direct effects from Alternative B to marten include a limited potential for individual mortality due to timber felling. The main threat to American martens are habitat fragmentation and timber harvest (Buskirk 2002). Indirect, long-term effects would include a loss of potential habitat due to management activities. American martens are closely associated with dense, mature and late successional forest conifer stands, especially spruce forests, in the Black Hills. Actions that modify spruce may modify marten distribution and abundance. There would be no treatment in areas dominated by spruce. However, spruce trees would be selectively removed from pine dominated stands.

Alternative B proposes treatment in 751 acres of marten corridor habitat. The impacts of treatment activities on identified marten corridors in the Project Area would be mitigated through identified design criteria. In areas dominated by spruce, no treatment would occur, as directed by Objective 239-LVD. In areas dominated by pine, between climax spruce stands, connectivity would be maintained by maintaining ponderosa pine or pine/spruce canopy cover at cover greater than or equal to 50 percent, as dictated by standard 3215.

Marten appear to require large expanses of contiguous forest (Fecske et al. 2003), and large clearcuts can fragment habitat. Mature ponderosa pine stands with moderate-or-high canopy cover that are not identified as connective corridors may also be used by marten for other purposes such as winter foraging habitat. This alternative would reduce mature ponderosa stands with moderate to high mature canopy cover, potentially impacting marten use. There would be a total reduction of approximately 12,292 acres of these types of stands. Late successional stands would be maintained, including 56 acres in MA 5.1 that would be more open following treatment.

Within home ranges, physical structure near the ground is the most important limiting factor to martens, with coarse woody debris being the most valuable form of structure, both for prey habitat and potential resting and denning sites. Other factors (e.g., snow, lower branches of live trees) can also contribute to structure near the ground (Buskirk 2002). Because coarse woody debris is an important component of marten habitat, several

standards and guidelines address slash retention and piles of woody material. Project-specific design criteria were developed to meet these standards and guidelines (Appendix B).

Prescribed burning and other fuel mitigation activities may reduce ground cover, which is an important component of marten habitat for thermal regulation in the winter months and also provides habitat for marten prey. Prescribed burning is proposed in some identified marten corridors and spruce habitat. Design criteria were developed to minimize the negative impacts of fire to spruce habitat and species associated with spruce. Other criteria were also developed to assure that there would be no direct ignition in spruce habitat, although it is likely that some back burning may occur. As a result, some down woody material may be lost initially, but an overall loss of habitat as a result of prescribed fire is not anticipated.

Alternative B may adversely impact individual martens, but is not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide. Forest Plan standards and guidelines would preserve sufficient connectivity between high quality habitats. At the Forest level, habitat is expected to be maintained through spruce habitat objectives and structural stage objectives.

Alternative B (Proposed Action) - Cumulative Effects

The direct and indirect effects of Alternative B combined with the past, present and reasonably foreseeable future actions would result in a decrease in spruce habitat for martens.

Objectives aimed at fire hazard reduction have the highest potential to impact marten habitat by reducing forest density and ground cover. Project Area design criteria, and identification and maintenance of marten corridors, would assure that connectivity of habitat is maintained on NFS lands in the Project Area.

Although there is a substantial amount of privately owned lands in the Project Area, most occurs in pine forest or in meadows. Where private lands do include high quality habitat, it could be subject to treatment or lost to development. Many landowners have been or could be conducting fuel reduction activities to protect their homes. Private land owners are not likely applying any mitigation to minimize effects to martens such as maintaining connective corridors; as a result habitat on NFS lands would likely become more important in the future.

Alternative C - Direct and Indirect Effects

Alternative C proposes 136 acres of thinning and pile burning in identified marten corridors, all within Spearfish Canyon. Approximately 299 acres of marten corridor habitat in the Project Area occurs within WUI zones. The majority of the fuels treatments in Alternative C are in a cover type other than spruce, and include pine, meadows, and other cover types not necessarily preferred by martens, but that would be part of an individual animal's home range.

Treating these potential corridors for fuel mitigation could be detrimental to marten if canopy cover was reduced below 30 percent since marten are intolerant of these conditions (USDA-Forest Service 2000). Due to the limitation of treatment to conifers less than nine inch dbh, most Alternative C treatment areas would likely maintain at least 50 percent canopy closure. The more large trees that exist in the WUI, the more closed the canopy would be following treatment. As a result, canopy coverage, and impacts to marten habitat

suitability following Alternative C treatments, would vary, and some marten corridor habitat could become unsuitable.

Because coarse woody debris is an important component of marten habitat, several standards and guidelines address slash retention and piles of woody material. Project Area design criteria (Appendix B) were developed to meet down woody standards and guidelines. However, since most of the proposed fuels treatments would occur within 300 feet of buildings, most piles created from fuels treatments would be burned. WUI fuel reduction treatments would also include limbing trees up to 15 feet from the ground to reduce ladder fuels. This would further reduce the suitability of these stands for marten occupancy.

American martens are closely associated with spruce forests in the Black Hills and actions that modify spruce may also modify marten distribution and abundance (USDA-Forest Service 2005a). Fuels treatments in Spearfish Canyon would reduce understory vegetation, down woody material and ladder fuels on 136 acres of identified marten corridor. Therefore, this alternative has a high probability of modifying marten distribution and abundance in the Spearfish Canyon area. Depending on habitat components of nontreated adjacent sites, martens may continue to persist in the area. However, most of this habitat appears to be less desirable for martens; therefore, there is a strong possibility that treatments would fragment the existing marten population in the northern Black Hills. With so many variables, it is difficult to determine how important changes would be to marten distribution and abundance, but it is likely that there would be changes, and that there would be negative impacts to the species. Since the existing marten population on the forest is relatively stable, Alternative C is likely have negative impacts on the species but is not likely to threaten species viability on the Forest.

Alternative C may adversely impact individual martens, but is not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide. If standards and guidelines are implemented, sufficient connectivity between high quality habitats would be preserved. At the Forest level, habitat is expected to be maintained through spruce habitat objectives and structural stage objectives.

Alternative C - Cumulative Effects

Cumulative impacts would be the same as discussed under Alternative B, with the added impact of additional treatments under Alternative C.

Beaver (*Castor canadensis*) - MIS Species

The beaver was selected as an MIS to evaluate the effects of Forest Plan implementation and natural change on the ability of the Forest to support species that rely on a variety of riparian and hardwood forest conditions to meet their needs. Beavers are adversely affected by predation, loss of food base due to wildfire or habitat overuse, and drought. Examples of indirect impacts to beaver habitat include changes in water flows, loss of willow, aspen, or cottonwood species, and alterations in water quality.

Habitat and Range

Beavers are semi-aquatic and widely distributed in large rivers and lakes with constant water levels, marshes, small lakes, and streams with weak flows adequate for damming (Higgins et al. 2000). General habitat

requirements include riparian areas dominated by stands of willow, aspen, or cottonwood (Streubel 1989). Beavers are nocturnal and active year-round. They are herbivores and prefer aspen, willow, cottonwood, and alder (Higgins et al. 2000). At one time, beavers were likely the most important biological influence on riparian systems of the Forest. Through dam construction, they can enhance and maintain aquatic and riparian communities by elevating water tables, reducing stream velocity and subsequent sedimentation and bank erosion, improving water quality, improving stream flow stability, and enhancing fish and wildlife habitat (Olson and Hubert 1994). Riparian and aquatic dynamics created or enhanced by beavers are considered beneficial to many plant emphasis species.

Occurrence in and Near the Project Area

Historically, beaver were heavily trapped in the Black Hills. By the late 1880s, low populations were restricted to remote areas (Parrish et al. 1996). The drastic reduction in beaver activity caused a lowering of alluvial water tables and loss of the woody plants dependent on higher water tables or flooded conditions (Parrish et al. 1996). Beaver have since increased and are now widely distributed in South Dakota (Higgins et al. 2000). Historic fire suppression has reduced the vigor of existing hardwood stands and inhibited stand regeneration (Parrish et al. 1996). Hardwoods are more abundant on the northern portions of the Black Hills and become sparse at the southern end of the Black Hills. Spearfish Creek and its perennial tributaries provide suitable habitat. Beaver have been observed in the Project Area.

Environmental Consequences for Beaver

Alternative A

Beaver are dependent on riparian hardwood habitats. Alternative A may cause some decrease in hardwood habitat due to pine encroachment. Riparian areas would not be enhanced. Available beaver habitat is expected to remain stable or decrease**.**

Alternative B (Proposed Action) - Direct and Indirect Effects

Alternative B has potential direct impacts, including short-term disturbance of riparian habitat. Long-term, indirect impacts include maintenance or enhancement of riparian areas. Prescribed fire could increase the amount of hardwood habitat, as hardwood species are less flammable than conifers, and fire hazard treatments would generally remove more conifers than hardwoods. Alternative B would enhance beaver habitat in the Project Area.

Alternative B (Proposed Action) - Cumulative Effects

The direct and indirect effects of Alternative B combined with the past, present and reasonably foreseeable future actions would be an enhancement of riparian and hardwood habitat, potentially leading to an increase of beaver populations in the Project Area. Cumulative effects to beavers would likely mirror cumulative effects to riparian and hardwood areas.

Riparian habitat in and adjacent to the Project Area has previously been impacted by humans such as overuse of livestock, mineral withdrawal and road crossings. Plan standards and guidelines should reduce these impacts

on riparian areas in the future. This alternative would decrease the risk of high intensity wildfire. Therefore, this alternative would have a lower risk of increased sediment yield to creeks and loss of riparian shrubs.

Within the Forest, a large portion of the riparian habitat that might be used by beavers is under private ownership. Urban development is expected to continue on private lands. Thus, while the Forest would take actions under all action alternatives that would generally lead to greater abundance of beavers in the Black Hills, actions on private land could have an offsetting effect.

Alternative C - Direct and Indirect Effects

Alternative C could cause a short-term increase in sediments and possible bank destabilization in Spearfish Creek due to increased road use and from fuel reduction activities. Indirect impacts are similar to those discussed for song sparrows (refer to song sparrow analysis). Fuels treatments in Spearfish Canyon do not include removal of hardwoods, and any positive response from hardwood species due to proposed treatments would benefit the beaver.

Overall impacts to beaver from changes in riparian habitat are difficult to assess for Alternative C. Increases in sediment and bank destabilization in Spearfish Creek would be detrimental, whereas improvements in riparian hardwood communities would be beneficial. Beaver are highly mobile and may move up or down streams to where better habitat conditions exist. Overall, assuming that the Forest would be moving towards the riparian objectives, it is expected that there would be little impact to the beaver population on the Forest if this Alternative was implemented.

Alternative C - Cumulative Effects

Cumulative impacts would be the same as discussed under Alternative B, with the added impact of additional treatments under Alternative C.

Fringed Myotis (*Myotis thysanodes pahasapensis*) and Townsend's Big-eared Bat (*Plecotus townsendii*) - Sensitive Species

The fringed myotis was selected as a Sensitive Species due to its patchy distribution, susceptibility to human disturbance, and limited roosting sites (USDA-Forest Service 2007e). It is more closely associated with forested habitat than other bat species and may be fairly sensitive to forest management, particularly the availability of snags (USDA-Forest Service 2000). Additional threats to the species include human disturbance in or near bat roost sites and hibernacula, which may cause site abandonment and local population losses.

The Townsend's big-eared bat was selected as a Sensitive Species due to declines in population and habitat region-wide (USDA-Forest Service 2007e). Potential reasons for this decrease include the restricted habitat of the species, their vulnerability to disturbance and naturally low reproductive potential.

Habitat and Range

Fringed Myotis

The Black Hills population of the fringed myotis is a disjunct population and recognized as belonging to a distinct subspecies, *Myotis thysanodes pahasapensis*. The species is a year-round resident of the Black Hills. It occupies a variety of habitats including mid-elevation desert, grass, and woodland habitats and is found at

higher elevations in spruce-fir and in mixed timber (Schmidt 2003a). In the Black Hills it is one of the more commonly captured bats during summer mist-netting studies and tends to occur along ecotones between ponderosa pine and oak/juniper forests (Schmidt 2003a). Riparian areas and water sources are important features of habitat. Open water is important because bats obtain water while flying. Riparian habitats are important for insect production and provide foraging opportunities. Snags, caves, mines, and buildings may be used as roosts (Schmidt 2003a). In the Black Hills, maternity roosts recorded for this species include rock crevices and ponderosa pine snags (Cryan et al. 2001).

Townsend's Big-eared Bat

Townsend's big-eared bats occupy a variety of habitats including forest edge, deciduous and mixed coniferous forests. Key habitat requirements are suitable maternity roosts and hibernacula, often located in cool caves and mines (Schmidt 2003b). They also use riparian areas for foraging, including wetlands and meadows (Pierson et al. 1999). Townsend's big-eared bats feed primarily on moths, whose life cycles are dependent upon native forest plants (Schmidt 2003b).

In the Black Hills, maternity roost sites are often in steep drainages with nearly vertical walls (USDA-Forest Service 1996a). This species is very sensitive to activities such as recreational caving and mine closings, especially at hibernacula and maternity roosts (Schmidt 2003b). Changes to vegetation around cave and mine openings can alter airflow patterns or temperature regimes, which can also impact bats (USDA-Forest Service 2000). Additional threats to the Townsend's big-eared bat include the loss of snags due to fuelwood gathering as well as disturbance of caves and mines from recreational use.

Occurrence in and Near the Project Area

Fringed Myotis

The fringed myotis has been documented using snags as day roosts in the Black Hills (Cryan et al. 2001). Due to recent fires, snags have increased and are likely above the three snag per acre Forest Plan Standard 2301.

The fringed myotis has been documented in the Black Hills roosting in rock crevices on rocky ridges or in steep walled canyons (Schmidt 2003a) that may be popular for rock climbing. Suitable habitat exists in the Project Area; 32 abandoned mines with open shafts have been found. Additional abandoned mines may exist on the Project Area. Potential habitat also exists in Community Cave as well as snags, cracks and crevices in Spearfish Canyon. This species has been observed in the Project Area (USDA-Forest Service 2007b).

Townsend's Big-eared Bat

Townsend's big-eared bat is a year-round resident in all South Dakota Black Hills counties. There are four known maternity roosts of these bats in the Black Hills, two of which are on the Forest (USDA-Forest Service 2000). Surveys have identified bat roosts on the Forest, but no long term trends are apparent. The Jasper fire in 2000 may have lead to a reduction of bats in one cave due to changes in vegetation. Suitable habitat exists in the Project Area in known abandoned mines and Community Cave as well as snags, cracks and crevices in Spearfish Canyon. This species has been observed in the Project Area (USDA-Forest Service 2007b), but no hibernation or nursery sites have been identified.

Environmental Consequences for Fringed Myotis and Townsend's Big-eared Bat

Alternative A

These species rely on the availability of snags, rocks, caves or mines for roosting, and on a variety of forest habitats for foraging. The continuation of forest succession and fire suppression would limit foraging opportunities by creating dense forests and decreasing hardwood habitats in riparian areas. Roosting habitat in snags is likely to increase with forest succession and the absence of active management. This alternative increases the risks from wildfire and mountain pine beetle outbreaks. These events at lower intensity levels could lead to an increase in snags, but current conditions favor high intensity, stand-replacing events which would not benefit these species. In the absence of high intensity fire or beetle outbreak, diversity of foraging habitat is likely to decrease and roosting habitat would likely increase.

Alternative B (Proposed Action) - Direct and Indirect Effects

Direct impacts on bats include the limited potential for individual mortality due to tree felling. Indirect impacts include loss of habitat due to the reduction of suitable roost snags if they are removed due to safety concerns or new road construction. This impact would be mitigated by maintaining all snags in treatment areas except for those that pose a safety hazard or are removed during road construction.

Alternative B would most likely improve foraging habitat through meadow enhancement and opening of pine stands. Insect populations may also increase after prescribed fires (Cerovski 2002), logging and thinning (Dykstra et al. 1999), increasing available bat prey.

Community Cave is the only known cave in the Project Area. Due to limited surveys, the importance of mines in the Project Area as hibernacula or maternity roosting sites is not known. No hibernacula or roosting sites have been discovered, but suitable habitat is likely to exist. To assure protection of potentially sensitive bat habitat, specific design criteria were developed and can be found in Appendix B.

Alternative B may adversely impact individuals, but are not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide.

Alternative B (Proposed Action) - Cumulative Effects

The direct and indirect effects of Alternative B combined with the past, present and reasonably foreseeable future actions would result in a reduction in roosting habitat in the Project Area. This would be mitigated by snag, mine and cave protection standards. Foraging habitat would increase under Alternative B. Populations of Townsend's big-eared bat and fringed myotis are expected to remain stable within the Project Area.

Potential bat habitat is expected to occur on private lands within and adjacent to the Project Area; however, the extent and persistence of such habitats is uncertain. Actions on private land could add to the cumulative impacts on bats. Some loss of hibernacula and maternity roosts has most likely occurred as a result of abandoned mine closures and recreational caving activities on private lands. However, given the conservation measures designed into the alternatives for caves, abandoned mines, and riparian areas on NFS lands, these bats are likely to persist in the Project Area.

Alternative C - Direct and Indirect Effects

Alternative C would have all the effects discussed for Alternative B. In addition, fuel mitigation treatments (removal of small diameter conifers from hardwoods) in Spearfish Canyon would likely benefit hardwood communities, providing additional foraging habitat. Hibernating bats along the cliff walls and caves could be impacted by the smoke that is generated by burning slash piles created by fuels treatments in the Canyon. To minimize impacts to homeowners and hibernating bats, pile burning would not occur in the Canyon if smoke inversions are likely to occur; thereby reducing the likelihood of bats suffering impacts from smoke inhalation.

Alternative C - Cumulative Effects

Cumulative impacts would be the same as discussed under Alternative B, with the added impact of additional treatments under Alternative C.

Alternative C may adversely impact individuals, but is not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide.

Rocky Mountain Bighorn Sheep (*Ovis canadensis*) - Sensitive Species

Habitat and Range

The range of the bighorn sheep includes southern British Columbia and southwest Alberta south to southeast California, Arizona, and New Mexico (Whitaker 1980). They inhabit alpine meadows, foothills, cliffs, and rock outcrops (Luce et al. 1999, Clark and Stromberg 1987). Their diet includes a variety of grasses, forbs, and browse (Luce et al. 1999). Merwin (2000) noted that bighorn sheep often select areas with good visibility (less than 40 percent canopy closure) within suitable distance of water and escape terrain.

Occurrence in and Near the Project Area

This species was once native to the Black Hills but was extinct by 1916 (Benzon and Halseth 1999). In 1991 and 1992, 31 Rocky Mountain bighorn sheep were transplanted into Spring Creek Canyon in the Black Hills (Benzon and Halseth 1999). Current estimate of the population is approximately 220 sheep (SDFG 2003). Limits to persistence include limited availability of habitat on the Forest, vulnerability of habitat to residential development on adjacent private lands, and disturbance from recreation as well as diseases transmitted from domestic sheep and goats (Benzon and Halseth 1999).

Bighorn sheep are rare in the northern Black Hills. They have occasionally been observed in Spearfish Canyon (MA 4.2A), but are mainly transient and are not known to lamb anywhere in the Project Area.

Environmental Consequences for Rocky Mountain Bighorn Sheep

Alternative A

Long term impacts under Alternative A include a reduction in grazing habitat as conifer encroachment on meadow habitat continues. Because bighorn sheep are transient in the Project Area, impacts on this species would be minimal.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Direct impacts from Alternatives B and C on big horn sheep would likely be minimal due to their limited distribution in the Project Area. Indirect effects are most likely positive, as the proposed activities would provide more open forest conditions. These conditions offer the best forage and the best potential for horizontal visibility. Forage for this species may improve if meadow and grassland restoration objectives are achieved.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of Alternatives B and C combined with the past, present and reasonably foreseeable future actions would result in a stable or slight increase in suitable habitat in the Project Area. Populations of big horn sheep are not expected to change in the Project Area. Privately owned meadow, montane shrubland, and rock outcrop habitat may also provide habitat.

White-Tailed Deer (*Odocoileus virginianus*) - MIS

White-tailed deer were selected as an MIS to evaluate the effects of Forest Plan implementation and natural change on the ability of the Forest to support species that rely on a variety of forest conditions, including the occurrence of understory shrubs (USDA-Forest Service 2006a). Elk and mule deer have similar habitat requirements and the discussion of white-tailed deer is used to indicate the existing conditions and effects to these species.

Habitat and Range

White-tailed deer are associated with forested and riparian habitats. They require a diversity of habitat types depending on season. Hardwood stands, which provide abundant forage and screening cover, provide white-tailed deer diurnal, summer use (Stefanich 1995). Preferred summer nocturnal habitat includes open habitat types of meadows, riparian areas, or open pine relative to proximity of dense cover (Stefanich 1995). Dense aspen habitats with dense, tall, shrub cover are important fawning habitat in the northern and central Black Hills (DePerno et al. 2002). Wet meadows, riparian areas, and open stands of ponderosa pine provide important forage areas.

Deer move to low elevation winter range from October to January, depending on snow and forage conditions (Stefanich 1995). In winter, white-tailed deer in the central Black Hills preferentially select forested habitat with shrubs (DePerno et al. 2002). Wooded draws and pine stands with closed canopies provide thermal cover while agricultural areas, recently logged areas, and open stands with abundant shrubs are important for forage. Bearberry juniper and snowberry provide important winter browse (DePerno et al. 2002). Closed-canopy stands with minimal understory vegetation represent cover habitat but provide little forage.

Occurrence in and Near the Project Area

Summer habitat conditions for white tailed deer are undergoing a moderate increase and winter conditions are stable to slightly decreasing (USDA-Forest Service 2006a). Local population trends are considered stable but vary annually (SDGFP unpublished data). In the Black Hills, white-tailed deer are considered common to locally abundant. The Forest Plan has an objective for habitat capable of supporting 60,000 white-tailed and

mule deer combined in the Black Hills. Currently, the Black Hills white-tailed deer population trend has increased to about 20,000 animals (66 percent) between 2000 and 2005. The Forest-wide summer habitat trend is stable to slightly decreasing. The Forest is meeting objectives with respect to summer habitat, but may not be maintaining winter habitat (USDA-Forest Service 2007e).

The Project Area contains suitable habitat for the white-tailed deer. Meadow and forage habitat are present as is thermal cover in forested areas. White-tailed deer have been observed in the Project Area (USDA-Forest Service 2007e). The Project Area includes 1,235 acres of big game winter range; however, terrain, aspect and water availability prohibit this area from providing optimal winter habitat for deer.

Environmental Consequences for White-Tailed Deer

Alternative A

White-tailed deer are limited by the availability of a diversity of forest habitats including understory shrubs and meadow habitat. The continuation of current fire suppression policies would increasingly limit deer and elk foraging habitat, as the growth of seral vegetation, aspen, oak, Oregon grape and other desirable shrubs would not be promoted (USDA-Forest Service 2005c). Meadow habitat for summer grazing would also increasingly be reduced due to pine encroachment.

Alternative A would not contribute to meeting structural stage objectives and would not work towards the Forest Plan objective of aspen restoration. Alternative A would negatively affect white-tailed deer by the continued lack of foraging habitat, but would provide positive benefits by maintaining existing thermal cover conditions. Since foraging habitat is lacking in the Project Area, this alternative is not expected to benefit white-tailed deer.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

The direct effects of Alternatives B and C may include increased deer mortality due to the increased number of vehicles on roads during harvest and prescribed burning. There would be 35 miles of new road and 126 miles would be reconstructed. Long-term, indirect impacts would include an increase in availability and quality of habitat for deer foraging. Clearcutting and non-commercial meadow enhancement would promote the growth of seral vegetation, aspen, oak, Oregon grape and other desirable shrubs.

One objective of the proposed actions is to create a diversity of structural stages through thinning. This would provide different levels of habitat requirements for deer. Open forest conditions offer the best forage, including the best potential for understory shrubs. Denser stands offer the best conditions for cover, including thermal cover. Prescribed burning and reduction of the timber canopy increases forage and browse production (Uresk and Severson 1989), but may do so at the expense of cover. The proposed treatments and changes in structural stages would increase forage production by about 8,960 acres and reduce thermal cover in the short-term (Table 28). The forage estimate is a generalization and likely an overestimate of foraging habitat because it does not consider the understory conditions of these stands (pine regeneration or shrubs). In the Project Area there is a greater concern for desirable shrubs for food and cover than for thermal cover (USDA-Forest Service 2005c).

Table 28. Change in Forage and Cover for White-Tailed Deer

	Forage in Ponderosa Pine Understory (structural stage 1, 2, 3A, 4A)	Thermal Cover (Structural stage 3C, 4C, and 5)
Existing Conditions	6,182 acres	6,243 acres
Alternatives B and C	15,142 acres	2,703 acres
Change	+8,960 acres	-3,540 acres

Clearcutting may be used to meet ecosystem objectives including enhancing diversity and providing forage for wildlife. Alternatives B and C propose clearcuts followed by prescribed burns, and clearcuts around hardwood enhancement sites to allow expansion of aspen habitat over 322 acres. There are 10 proposed clearcut units ranging in size from 5 to 39 acres. These clearcuts would increase the amount of grass and shrubs available to deer, primarily on ridgetops, and would emulate natural openings. They would also diversify the forest cover throughout the Project Area and provide a fuel break above Spearfish Canyon.

MA 5.4 emphasizes Big Game Winter Range. In winter range the Forest Plan stipulates that temporary openings in the grass/forb stage should be between 1 to 10 acres. There are eight clear cut treatments within MA 5.4 (Big Game Winter Range) and six are above 10 acres in size. These clearcuts do not fully meet Forest Plan guidelines in the short-term, but they are moving towards the guidelines for creating openings in the grass/forb stages within the Management Areas that emphasize Big Game Winter Range.

An important component of summer range management is enhancing hardwood communities. These alternatives include approximately 427 acres of non-commercial hardwood enhancement and 4,149 acres of commercial thinning. Both of these activities could improve foraging opportunities and spring/summer habitat for the white-tailed deer.

Alternatives B and C would increase deer foraging habitat and comply with Forest Plan Objective 238: support habitat for management of 60,000 white-tailed and mule deer combined in the Black Hills. These alternatives propose clearcuts that do not fully meet guideline 5.4-3201, but would be moving towards the guidelines for creating openings in the grass/forb stages within the Management Areas that emphasize Big Game Winter Range. These clearcuts would enhance foraging habitat. White-tailed deer would be expected to be positively affected by an increase in foraging habitat and minimally impacted by a decrease in thermal cover, as this habitat is not a limiting factor in the Project Area. Overall, these action alternatives are expected to benefit white-tailed deer.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of Alternatives B and C combined with the past, present and reasonably foreseeable future actions would create habitat conditions that could lead to an increase of white-tailed deer populations in the Project Area. Habitat connectivity is important for white-tailed deer as they move between their higher elevation summer ranges and their lower elevation winter ranges. Privately owned lands within and adjacent to the Project Area may also provide suitable and important habitat for the white-tailed deer.

Much of the crucial winter range is on private agricultural lands at low elevations and this habitat is likely to remain important. Alternatives B and C would add to this habitat base. Cumulatively, there would be a beneficial impact to regional deer habitat availability. The majority of project roads would be closed after the project, so there would be no cumulative impacts from roads.

Northern Leopard Frog (*Rana pipiens*)

The northern leopard frog was selected as a Sensitive Species due to substantial declines and local extirpations and for the influence Forest Service management can have on leopard frog conservation (USDA-Forest Service 2007e). Risk factors identified by Smith (2003) include inadequate regulatory protection of smaller seasonal and semi-permanent ponds, introduced predatory fish, lack of protection at overwintering sites, water quality degradation due to chemicals, loss of migratory pathways, introduced diseases, and road-related mortality.

Habitat and Range

Northern leopard frogs are found in the northern United States and Canada with additional populations in the higher elevations of the Rocky Mountains (Smith 2003). They are considered common in suitable habitat in the Black Hills, but appear to be more common in the northern Black Hills (USDA-Forest Service 2000; Smith 2003) and are found at all elevations. The northern leopard frog occurs in a wide variety of habitats including creeks, lakes, ephemeral wetlands, and ponds (Fischer et al. 1999; Smith 2003). Breeding and overwintering habitat is limited to permanent water sources at least 6 inches in depth that do not freeze solid (Baxter and Stone 1985). This species probably breeds in May or June depending on elevation (Smith 2003). Emergent vegetation is important in providing protective cover in ponds and lakes that contain predatory fish (Smith 2003). 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. After breeding, adult frogs can be found feeding in upland habitats of grasslands, meadows, and pastures adjacent to breeding areas. Adult frogs are highly mobile, moving at night or when vegetation is wet (USDA-Forest Service 1996a). They have been found up to two miles from water (Smith 2003).

Occurrence in and Near the Project Area

Current leopard frog distribution appears reasonably high (USDA-Forest Service 2004). In the Black Hills, it is believed this species has been reduced from its historical abundance due to the reduction in beaver populations and the habitat associated with their dams (Parrish et al. 1996; USDA-Forest Service 2000). Reservoirs and stock dams provide potential habitat (USDA-Forest Service 1996a), although most of these artificial water sources were created for and are heavily impacted by livestock and have limited suitability for frogs. Suitable habitat exists in riparian areas surrounding Spearfish Creek and its tributaries. This species has been observed in the Project Area (USDA-Forest Service 2007b).

Environmental Consequences for Northern Leopard Frog

<u>Alternative A</u>

This species depends on riparian and aquatic areas. Water quality would continue to be negatively impacted by existing sources of pollution and sedimentation. Alternative A would not enhance riparian habitat. Predation threats from non-native fishes would also continue to negatively impact leopard frogs. The likelihood of high

intensity fire increases under this alternative. Should a high intensity fire occur, water quality and riparian habitat would likely be negatively affected due to reduction of cover, increased erosion and sedimentation. Overall, effects on habitat quality would continue to have a negative impact on the species.

Alternative B (Proposed Action) - Direct and Indirect Effects

Potential direct effects to northern leopard frog from Alternative B include individual mortality of eggs, larvae, and adult frogs due to increased vehicle traffic, and newly constructed roads and stream crossings. Construction of 35 miles of new roads and 126 miles of reconstructed road are planned for the Project Area. Construction of roads may have a negative impact on leopard frogs by displacing or compacting soils and removing or disturbing ground litter. Reductions in downed woody material due to prescribed burning activities would also negatively impact leopard frogs by reducing cover. Effects should be minimized by implementation of specific design criteria.

Alternative B would not restore riparian areas; however, it would maintain or enhance riparian areas. In addition to breeding, tadpole, and overwintering habitats, leopard frogs require nearby diverse and productive upland foraging areas. Several standards and guidelines recommend managing for diverse, high quality riparian, meadow, and shrub communities. These measures would be met in the Project Area though specific design criteria.

Although leopard frogs are considered common in suitable habitat, gaps do exist in their distribution (USDA-Forest Service 2000; Smith 2003). There would likely be an increase in extent of these habitats if riparian and aquatic objectives are achieved. The proposed action would not further fragment stream habitat above existing conditions.

Alternative B may adversely impact individuals, but is not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide.

Alternative B (Proposed Action) - Cumulative Effects

The direct and indirect effects of Alternative B combined with the past, present and reasonably foreseeable future actions would result in maintenance of the riparian and aquatic habitat within the Project Area. Riparian and aquatic habitat would be enhanced in some areas (see West Rim Hydrology and Soils Resource Report [JW Associates 2008f]). Cumulative effects to northern leopard frog would likely mirror cumulative effects to riparian and wetland and aquatic areas.

Non-native predatory fish would continue to be a threat to leopard frog persistence. Indirectly, habitat enhancement efforts may promote sustainable or improved recreational fisheries, which may have a detrimental effect on the frog. Existing barriers, such as dams, culverts, and in-stream habitat structures that may impede the passage of aquatic organisms would persist on NFS and non-NFS lands. Drought may continue to affect the amount of habitat available for frog reproduction, adding to the cumulative impacts on habitat.

Efforts to restore beaver, through the enhancement of hardwood and riparian habitat, would benefit the frog through the creation of additional suitable habitat. These are long-term benefits as beaver populations would be dependent on riparian and hardwood restoration efforts.

Private in-holdings occur frequently within riparian areas. These private lands provide suitable habitat, but conditions may have been altered by private land management activities, such as the removal of beaver dams, draining to convert to drier site conditions for subsequent haying, and loss of habitat for homes and lawns. The loss of beaver-created habitat may be partially offset by the creation of artificial impoundments for livestock water, recreational or other purposes, although most of these artificial water sources are heavily impacted by livestock and have limited suitability for frogs.

Alternative C - Direct and Indirect Effects

Alternative C would have the same effects as Alternative B with the following additional effects.

Fuel treatments are proposed to thin conifers in the Spearfish Canyon, enhancing aspen, oak and cottonwood stands. These treatments, as well as construction of stream crossings, have the potential to negatively impact aquatic and riparian habitat in the Project Area. Design criteria would minimize impacts (Appendix B). In addition, Forest directives require that streams within Condition Class III watersheds (see Water Resources Specialist Report, 2008) with additional planned stream crossings, such as Lower Spearfish Creek, would be evaluated and repaired. This would provide long-term enhancement to the aquatic habitat by reducing sediment.

Alternative C - Cumulative Effects

Cumulative impacts would be the same as discussed under Alternative B, with the added impact of additional treatments under Alternative C.

Alternative C may adversely impact individuals, but is not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide.

Black Hills Redbelly Snake (*Storeria occipitomaculata pahasapae*)

The Black Hills redbelly snake has been chosen as a Sensitive Species because its restrictive distribution creates a substantial vulnerability to habitat modification (USDA-Forest Service 2007e). The most serious risk to redbelly snake populations may be the loss of mesic habitats (Smith and Stephens 2003).

Habitat and Range

This subspecies is limited to the Black Hills region of extreme northeastern Wyoming and extreme southwestern South Dakota. It is an isolated population associated with mesic sites such as wetlands, riparian areas, and wet meadows (USDA-Forest Service 2000). Sites where the snake has been observed range in elevation from 4,700 to 6,400 feet (Peterson 1974). There is some indication that redbelly snakes may feed on snails (and on the genus *Oreohelix*, preferentially), implying that habitat management aimed at snails may also benefit the Black Hills redbelly snake (USDA-Forest Service 2000).

Occurrence in and Near the Project Area

Biological opinion suggests that the redbelly snake is reasonably common in the Black Hills. However, this population is an isolated subspecies and endemic to the Black Hills. Several den sites have been found in the

Black Hills with hibernacula located within rock fissures (USDA-Forest Service 2000). The observations are located across the central and northern portions of the Black Hills.

Suitable environments for redbelly snakes are thought to be abundant and broadly distributed across the Black Hills (USDA-Forest Service 2000). The northern Black Hills, being generally moister and more fire resistant than the rest of the Forest, likely provides more habitat than other districts of the Forest (USDA-Forest Service 2000). Stumps and downed woody material are important in maintaining moist conditions (USDA-Forest Service 2000, Smith and Stephens 2003). Both hardwood and riparian habitats on the Forest have generally decreased in area. This may have reduced redbelly snake habitat.

Multiple redbelly snakes have been observed in the Project Area (USDA-Forest Service 2007b). No hibernacula have been identified. Spearfish Canyon is likely to provide suitable habitat due to the abundance of *Oreohelix* (snails) in the area.

Environmental Consequences for Black Hills Redbelly Snake

Alternative A

The redbelly snake depends on mesic sites, riparian areas and hardwood habitat. Under this alternative, a long-term reduction in aspen groves is possible due to continued ponderosa pine encroachment. Riparian habitat would not be enhanced under this alternative. This alternative has a greater risk of high intensity forest fire and pine beetle outbreaks. These events could increase herbaceous growth if stands are destroyed, but decreased canopy cover may dry out the soil. In the absence of stand replacing fires, habitat in the Project Area is expected to remain stable or decrease in the next 20 years.

Alternative B (Proposed Action) - Direct and Indirect Effects

Potential direct effects from Alternative B to the Black Hills redbelly snake include the potential for disturbance of habitat by machinery used for road construction and timber removal (Smith and Stephens 2003). Additional roads in the Project Area would also increase the opportunity for individual mortality in road kills.

Management activities that affect mesic habitats may have long term impacts on the redbelly snake. Hardwood treatments may result in short-term disturbance to snakes or their habitats, but may provide better quality habitat in the long-term due to increased moisture compared to pine forests. Proposed hardwood treatment activities should enhance 528 acres of aspen.

Fuel treatments are proposed to thin conifers in the Spearfish Canyon. These treatments may enhance aspen, oak and cottonwood stands and may increase hardwood habitat in the long-term. Short-term, there would be an overall reduction in down woody material. Downed logs and woody debris are crucial in maintaining moist soil conditions, habitat for prey species, and providing refugia for redbelly snakes from predators. Implementation of Standards and Guidelines 2307, 2308 and 3117 would provide some down logs and wood piles to minimize impacts associated with the loss of down woody material on treatment sites.

Impacts on hibernacula are unknown as hibernacula have not been located. Should any hibernacula be discovered, the location of roads would be designed to avoid new barriers between the hibernacula and wet areas. Design criteria in the Project Area incorporate this standard.

The effects of management activities would also be mitigated by riparian and meadow objectives, WCPs and BMPs and standards and guidelines in the Forest Plan, which would be met in the Project Area through the use of design criteria. These objectives restore and expand areas of suitable habitat for the redbelly snake by improving vegetative condition, structure, and diversity.

This alternative would potentially increase suitable mesic habitat through treatments in riparian and hardwood habitats, potentially leading to an increase in redbelly snake populations in the Project Area. Alternative B may adversely impact individuals, but is not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide.

Alternative B (Proposed Action) - Cumulative Effects

The direct and indirect effects of Alternative B combined with the past, present and reasonably foreseeable future actions would result in a potential increase in suitable mesic habitat through treatments in riparian and hardwood habitats, and a related increase in redbelly snake populations in the Project Area.

Privately owned forest lands within and adjacent to the Project Area may provide suitable habitat. Continued fuel treatments on private lands would likely continue to affect habitat, including riparian areas, thereby increasing the importance of habitat on NFS lands.

Alternative C - Direct and Indirect Effects

Black Hills redbelly snakes are most likely to occur in Spearfish Canyon riparian areas. Fuel mitigation treatments from Alternative C in Spearfish Canyon could have short-term negative impacts to snakes due to increased disturbance from treatments. However, over the next 20 years, impacts to hardwood communities may be positive, as the removal of conifers and retention of hardwoods may lead to increased moisture in treatment areas.

Project Area design criteria were developed to meet down woody material standards and guidelines. However, since most of the proposed fuels treatments would occur within 300 feet of buildings, most piles created from fuels treatments would be burned. Since some down woody material would be retained, this important habitat component would not be lost entirely. Overall, redbelly snake habitat would be negatively altered in the short-term by proposed treatments, which may make treatment areas less suitable for the redbelly snake.

There is some indication that redbelly snakes feed on snails (*Oreohelix cooperi* in particular) (USDA-Forest Service 2006a). Therefore, impacts to snails and snail habitat may in turn negatively impact redbelly snakes (refer to *Oreohelix cooperi* analysis below).

Alternative C - Cumulative Effects

Cumulative impacts would be the same as discussed under Alternative B, with the added impact of additional treatments under Alternative C.

Alternative C may adversely impact individuals, but are not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide.

Mountain Sucker (*Catostomus platyrhynchus*) - MIS Species

This species was selected as a Sensitive Species due to threats to populations from hydrologic modification, competition from introduced species, the effects of land use practices, and irrigation on water quality. Across the region, the mountain sucker appears to be in a downward trend and has experienced long-term range retraction (USDA-Forest Service 2007e). The Forest-wide population trend for mountain sucker is declining (USDA-Forest Service 2007a).

Habitat and Range

Mountain suckers occur most often in cool, clear mountain streams with moderately swift water. They are commonly found on stream bottoms associated with cover. Mountain suckers are benthic feeders, their diet consisting primarily of simple plants like diatoms and green algae. Small invertebrates are also ingested. In the Black Hills, spawning is most likely between June and early July. Short migrations may occur to spawning areas (USDA-Forest Service 2007d).

Occurrence in and Near the Project Area

Mountain sucker numbers and distribution are affected by the ongoing drought, which reduces or eliminates stream habitat. A denser forest and the subsequent effect on water production was believed to be the biggest single factor in the loss of stream flow and related habitat for mountain suckers in the Black Hills according to Stewart and Thilenius (1964). Forest density has continued to increase since this survey. Interaction with non-native fish species may also have reduced the number or distribution of mountain suckers due to predation and increased competition (USDA-Forest Service 2007a). Construction of passage barriers, such as dams and culverts, results in population and habitat fragmentation, leaving populations vulnerable to extirpation. In addition, habitat degradation due to increased sedimentation has contributed to population declines (USDA-Forest Service 2007d).

A total of 40 electrofishing surveys have been conducted at 24 sites along the main stem of Spearfish Creek since 1992. Mountain sucker was not detected in any of these surveys (USDA-Forest Service 2007d). In addition, mountain sucker was not reported in other stream surveys done in the early 1960s (Stewart and Thilenius 1964) or the mid-1980s (Ford 1988). The only tributary in the Spearfish Creek watershed where mountain sucker has been documented is Annie Creek (SDGFP 2005).

Environmental Consequences for Mountain Sucker

<u>Alternative A</u>

Mountain sucker is limited by aquatic habitat quality and connectivity. This alternative would negatively impact water quality in Annie Creek. Non-native fish would continue to be an impediment to expansion of sucker into Spearfish Creek. Natural factors, such as drought, would continue to fragment habitat on a variable basis. Overall, effects on habitat quality and connectivity would continue to have a negative impact on the species.

Alternative B (Proposed Action) - Direct and Indirect Effects

Annie Creek is the only stream in the Project Area with documented habitat for the mountain sucker. Alternative B proposes two new stream crossings within the Annie Creek watershed. The design of the new road crossings would follow design criteria to protect the creek and would be consistent with Standard 1203. A total of 29 percent of the Annie Creek watershed is in the treatment area. The only proposed vegetative treatments near Annie Creek, however, are seed cut and commercial thinning proposed for the ridgetops to the north and south, and above this Creek. These treatments are not likely to affect water quality. No fuel treatments are proposed along Annie Creek. Any potential impacts to Annie Creek and other streams would be minimized through the use of BMPs and aquatic and riparian guidelines, implemented through specific design criteria. Impacts to mountain sucker are not expected and therefore Alternative B would have a neutral effect on the Forest-wide mountain sucker populations.

Alternative B may adversely impact individuals, but is not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide. At the Forest level, habitat is expected to be maintained through aquatic and riparian objectives. Alternative B would work towards these objectives.

Alternative B (Proposed Action) - Cumulative Effects

The direct and indirect effects of Alternative B combined with the past, present and reasonably foreseeable future actions would be maintenance or enhancement of the aquatic habitat in the Project Area. Aquatic habitat within and adjacent to the Project Area has previously been impacted by human use through pollution from mining and timber harvest. Forest Plan standards and guidelines should reduce these impacts on aquatic areas in the future.

The amount and quality of mountain sucker habitat is also influenced by land management and development on private in-holdings, most of which occur along streams. Stewardship of private lands varies and likewise the contribution of these lands in maintaining mountain sucker populations also varies.

Alternative C - Direct and Indirect Effects

This alternative would include the effects discussed for Alternative B. Under Alternative C, additional potential effects would include structure buffer treatments that occur near the mouth of Annie Creek, where it feeds into Spearfish Creek. However, these treatments are not expected to present additional effects. Long-term changes in water quality or quantity to Annie Creek would not occur. Therefore, stream habitat would be maintained and mountain sucker populations would not be impacted from Alternative C. Impacts to mountain sucker are not expected and therefore Alternative C would have a neutral effect on the Forest-wide mountain sucker populations.

Alternative C - Cumulative Effects

Cumulative impacts would be the same as discussed under Alternative B, with the added impact of additional treatments under Alternative C.

Alternative C may adversely impact individuals, but is not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide. At the Forest level, habitat is expected to be maintained through aquatic and riparian objectives.

Cooper's Mountain Snail (*Oreohelix strigosa cooperi*)

This species was selected as a Sensitive Species due to its range-wide population decline and extirpation, resulting in range shrinkage (USDA-Forest Service 2007e). Additional concerns exist due to threats to current populations and limited ability to recolonize after population extirpation.

Habitat and Range

In the Black Hills, Cooper's snail was found on calcareous soils; most localities were lowland wooded areas and talus slopes, generally but not always with northern or eastern exposures. Many of the colonies, including most of the largest, are found in ponderosa pine with a partially closed canopy, a secondary deciduous tree component, and diverse understories. At some sites, white spruce was common. Riparian woodland communities, often in areas with adjacent steep rocky slope bases, were also found to contain some substantial colonies. This species generally dominates the mollusk fauna in the area of occurrence, but it has been found to occur with two other species of land snail: the callused vertigo and striate disc.

Locations are concentrated in the northern and western Black Hills (Anderson 2005). In contrast to other land snails, Cooper's snail can thrive with little cover and thin litter (Anderson 2005). *Oreohelix* have been observed in a variety of litter types in the Black Hills, including coniferous needles litter, deciduous litter and areas of thin litter (Anderson 2005).

Occurrence in and Near the Project Area

Across the Forest, when comparing original survey data with that replicated in 1999, five sites appear to have lost the Cooper's snail and one site gained Cooper's snail. In addition, sites surveyed for the first time in 1999 show Cooper's snail at 42 sites (USDA-Forest Service 2007a).

Cooper's snail colonies appear to have been negatively impacted by road construction, grazing, logging, herbicide and pesticide application, and forest fires. No colonies were found in areas that were heavily grazed or completely logged (Frest and Johannes 2002). Timber harvest and grazing may affect snails by altering the amount of litter, soil moisture or temperature for snail colonies (Anderson 2005). Although fire is a natural disturbance, high intensity fire can potentially eliminate snail habitat (Anderson 2005). Forest management, including fire suppression, in the last century has led to fuel buildup, which may promote high intensity fires. Road construction and maintenance can also affect snails by eliminating habitat or killing snails. Roadside brushing or weed spraying can also damage snails or their habitat (Anderson 2005). Several known locations of Cooper's mountain snail are near roads.

Numerous surveys have documented Cooper's mountain in the Project Area. It is common knowledge that snail colonies exist throughout a large portion of Spearfish Canyon (USDA-Forest Service 2007c). However, because more extensive snail surveys are lacking in Spearfish Canyon and across the Forest, the extent of the population on the Forest is unknown. It is reasonable to assume and is widely believed that Spearfish Canyon is the stronghold for Cooper's mountain snail on the Forest. Frest and Johannes (2002) state, "Land snail

diversity is concentrated in certain portions of the Black Hills National Forest. Certain drainages are particularly important. Preeminent is Spearfish Creek and Spearfish Canyon, almost from its mouth to the headwaters."

Environmental Consequences for Cooper's Mountain Snail

Analysis of the effects of the West Rim project on Cooper's mountain snail is based primarily on the research of Frest and Johannes (1993, 2002) and a regional technical conservation assessment conducted by Anderson (2005). Frest and Johannes determined that this species is very limited in population size and in habitat range, with the entire population being located in the Black Hills and a large proportion of it in Spearfish Canyon. Frest and Johannes also propose that the Black Hills population represents a separate species, *Oreohelix cooperi*, rather than a sub-species, *Oreohelix strigosa cooperi*, a theory that has yet to be proven. Anderson included information from Frest and Johannes in her assessment. Anderson's assessment makes it clear that there is an overall lack of knowledge regarding the biology, distribution and ecology of the Cooper's mountain snail, making determination of the effects of management activities difficult at best.

Information that would strengthen the determination of effects of the proposed activities on Cooper's mountain snail is lacking. Much of the information currently in use to analyze the effects of management activities on Cooper's mountain snail is based off of studies conducted for other snail species (Anderson 2005). Comprehensive snail surveys have not been conducted in the Project Area, or elsewhere in the Black Hills, to determine the habitat range of this species. Also, intense studies of the species to determine breeding habits, community ecology, habitat preference or selection, and the species-specific effects of management activities have not been conducted. Anderson states: "Much of the basic biology of *Oreohelix strigosa cooperi* remains unknown, and without detailed information on microhabitat requirements and life history of this species, it is impossible to state the effects of management activities with certainty." This information would allow for stronger analysis of the effects of proposed activities on snails and their habitat. Such surveys would also reveal if the snail is as limited in population and available habitat as currently believed, or if the population is more widespread, and therefore less susceptible to alterations of preferred habitat, than currently assumed.

A determination on the taxonomical status of the Cooper's mountain snails would also be beneficial in determining the actual population status of the species. If the Cooper's mountain snail is a distinct, isolated species, as suggested by Frest and Johannes, then the population would conceivably be at higher risk. If, however, the Black Hills population is a sub-species, as is currently believed, then the overall population size would be larger and impacts to the Black Hills portion of that population would represent less of a threat to the overall population. A study of the genetics of *Oreohelix* is underway at the University of Colorado, but no determination has been made (Anderson 2005).

Anderson (2005) lists four research items that are of "high priority" for Cooper's mountain snail in Region 2:

1) Determine if the Black Hills population is a separate species or sub-species;

2) Conduct studies to estimate population size at multiple locations;

3) Determine how snails respond to disturbances; and

4) Identify microhabit needs of the species.

This information would be beneficial in determining the overall status of Cooper's mountain snail in the Black Hills as well as in determining more precisely the potential effects of the proposed management activities in the West Rim Project Area. However, it is unrealistic that this information will be available in the near future do to the current lack of funding for such species-specific research. Therefore, this analysis of the effects of the West Rim project on Cooper's mountain snail is based on the best scientific information currently available.

Alternative A

This snail species depends on undisturbed, shady habitat with organic surface litter. Long-term habitat changes under this alternative would be an increase in canopy cover, shade and organic material, providing additional snail habitat. Due to the currently restricted distribution of the species on the Forest and limited dispersal capability, changes in habitat are not expected to substantially increase species distribution on the Forest.

Alternative B (Proposed Action) - Direct and Indirect Effects

Potential direct effects from Alternative B to Cooper's mountain snail include individual mortality due to timber harvest, road building and prescribed burns on unknown snail colonies.

Cooper's mountain snail is extremely sensitive to changes in their environment, although specific tolerance levels to disturbances are unknown. Anderson (2005) states, "Snails are generally susceptible to activities that modify their preferred habitat and/or change the temperature and moisture at the soil or litter level. Additional microhabitat condition (e.g., soil type, type and amount of litter, amount of cover from rocks or woody debris) also play a role in where the snails can survive.

Indirect effects include habitat alteration due to timber harvest. Alternative B would lead to a more open forest condition in some areas. Specific data on how silvicultural treatments affect snails does not exist; however, it is logical for a species that depends on microhabitat conditions that any action affecting the amount of litter, soil moisture, or temperature would negatively impact snails at that location (Anderson 2005). Silvicultural treatments could lead to an increase in understory shrubs, which may improve habitat conditions for the snail in some areas. However, since any existing colonies on a treatment site would likely be lost during treatment activities, and since snail dispersal rates are slow, and snail colonies are often small and isolated, dispersal and establishment of snail colonies in most of these locations is unlikely.

New roads needed for timber management activities could potentially go through unknown snail colonies, in which case those colonies would be lost. Road maintenance would occur throughout the Project Area and known and unknown snail colonies would likely be affected by these activities. However, road maintenance was considered under the Phase II analysis and is therefore not a violation of Forest Plan Standards.

Prescribed burning is proposed for 13,764 acres in the Project Area. Fire could negatively affect unknown snail colonies, as was found in the Jasper Fire area (USDA-Forest Service 2004). However, since prescribed fires typically do not burn uniformly and are less likely to burn on moist sites where snails are likely to occur, snails are less likely to be negatively impacted by a prescribed fire than a wildfire.

Design criteria have been developed to assure that known snail colonies in the Project Area are protected (primarily through avoidance) from timber harvest, road building, and prescribed burns. These criteria are presented in Appendix B.

Alternative B may adversely impact individuals, but is not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide. Alternative B may have both beneficial and negative impacts to the Cooper's mountain snail population depending on site conditions.

Alternative B (Proposed Action) - Cumulative Effects

The direct and indirect effects of Alternative B combined with the past, present and reasonably foreseeable future actions would decrease suitable habitat for Cooper's snail. Treatments in Spearfish Canyon could have negative or positive impacts on snails over the next 20 years. Recent and proposed future projects in Spearfish Canyon include construction of parking areas, road construction through NFS land to private in-holdings, above and below ground utility corridors, weed control and road maintenance activities. Cumulative effects to the Cooper's mountain snail would likely mirror cumulative effects to their habitat.

Privately owned forest lands within and adjacent to the Project Area may also provide suitable habitat for snails, but it is difficult to predict future trends in private forest structure and diversity. However, it is reasonable to assume that new construction of homes, driveways and utility corridors in Spearfish Canyon would occur over the next 10 years. Cooper's mountain snail colonies on development and construction sites on private in-holdings would be lost as a result of these activities.

Alternative C - Direct and Indirect Effects

Alternative C proposes an additional 928 acres of fuels treatments (568 acres in fuel management buffers and an additional 360 acres in natural fuels treatments) in Spearfish Canyon. According to survey data, there are 13 acres of suitable snail habitat within these additional treatment areas. Survey data is limited, and it is common knowledge that snail colonies, particularly Cooper's mountain snail, exist throughout a large portion of the Canyon (Frest and Johannes 2002). It is therefore likely that additional habitat exists and may be impacted by activities in this alternative. WUI fuels treatments outside of Spearfish Canyon are not expected to impact Cooper's mountain snail because there are no known snail colonies on any of these sites, and habitat is not likely present. Therefore, this analysis will focus exclusively on fuels treatments added under Alternative C in Spearfish Canyon. These impacts are in addition to those already described for Alternative B.

The 686 acres of additional treatments occur primarily in spruce and ponderosa pine habitat. These activities would likely change the microhabitat of the forest floor within what is believed to be the stronghold for this species. The biggest impacts to snail habitat under Alternative C would result from the removal of organic material, logs and downed woody material, and the thinning and removal of small diameter conifers, which would reduce the shade and moisture of the habitat. Frest and Johannes (2002) state, "The removal of coarse woody debris and litter (often followed by burning slash) is particularly objectionable." Weed infestations, which are likely to occur on disturbed sites after conifer removal and pile burning, compound the effects of treatments by further altering microhabitat and increasing the risks associated with weed control in the Canyon. Herbicide application is a serious concern as herbicides are lethal to snails.

Design criteria for fuels treatments in Spearfish Canyon have been developed to minimize effects by limiting conifer removal to trees less than nine inches dbh and retaining spacing of trees at 16 feet. The tolerance thresholds of snails, however, are not known; therefore, the specific impacts of changes in shade and moisture cannot be determined. To reduce the impacts of pile burning, piles would be burned only when snails are hibernating. This mitigation measure is required through design criteria and may reduce, but not prevent, snail mortality. To assure that litter composition is not altered if slash is chipped, design criteria were developed to remove chips from the site. To assure that snails and other sensitive resources are not crushed and soils are not disturbed by equipment, design criteria restrict mechanical equipment (e.g., chippers, ATVs, vehicles, etc) to paved or graveled surfaces or frozen ground. In summary, it is unknown if design criteria developed to minimize impacts to snails would be sufficient to protect the species and assure continued occupancy on treated sites in the Canyon, and it is likely that even if design criteria are implemented, the proposed treatments would likely result in the loss of snail colonies and their habitat.

Alternative C was designed in a way that attempts to adhere to all Forest Plan standards, including standards 3103 and 4.2A-4104, which protect snails and allow for WUI fuel reduction treatments in Spearfish Canyon, respectively. This alternative may be inconsistent with standard 3103 due to potential changes in moisture regimes from the proposed fuel reduction treatments. However, Alternative C would still be consistent with the Forest Plan because it follows MA-specific direction (standard 4.2A-4101), which takes precedent over the Forest-wide direction (standard 3103) (USDA-Forest Service 2008).

Standard 3103. Manage known sensitive species and species of local concern snail colonies to: Retain overstory sufficient to maintain moisture regimes, ground level temperature and humidity.

It is unknown whether Alternative C can accomplish this. Since up to 9 inch dbh trees would be removed, the canopy would be opened to some degree, and most down woody material would be removed. Tree spacing would be maintained at approximately 16 feet. Changes in humidity and temperature regimes would vary depending on site conditions, density of trees and understory being treated, density of larger diameter trees on site, hardwood composition, hill shade, tree species being treated (i.e., spruce vs. pine) proximity to water, and down woody material retained on site. Not only are changes in temperature and moisture regimes unknown, it is also unknown what snail tolerance levels are; therefore, the impacts of the proposed treatments to snails in Spearfish Canyon are unknown.

<u>Retain ground litter, especially deciduous.</u>

Alternative C would remove most down woody material and pile and burn or chip the slash to reduce fuel loading. Down woody material standards would apply, but it is unknown how removal of down woody material would affect snails since down woody material and the duff layer are critical to snails. Removal of down woody material, also known as ground litter, is inconsistent with Standard 3103.

<u>1) Avoid burning, 2) heavy grazing, 3) off-highway vehicles (OHVs), 4) heavy equipment and 5) other activities that may compact soils or 6) alter vegetation composition and ground cover.</u>

Alternative C proposes pile burning, which is inconsistent with Standard 3103. Piles would be burned in the Canyon only in the winter when snails are hibernating to minimize impacts to snails, but hibernating snails,

located beneath or near piles, may still be impacted. No grazing occurs in Spearfish Canyon and no changes in grazing are proposed. No off-road vehicles or heavy equipment would be used to accomplish fuels reduction projects in the Canyon; therefore soil compaction is not an issue. Vegetation composition would be affected since conifers would be removed; to what extent is unknown and based on site specificity. Most down woody material would be removed in treatment areas, altering ground cover. Both of these activities are inconsistent with Standard 3103. Wood chips from chipping would be hauled off-site in order to prevent additional changes in litter composition and depth on the Canyon floor.

If prescribed burning is unavoidable, burn when snails are hibernating, usually below 50 degrees Fahrenheit, and use fast-moving fires to minimize effects to snails

No prescribed fires are proposed in the Canyon in Alternative C, but winter pile burning is proposed.

Control invasive weeds, but use herbicides when snails are not on the surface, and treat individual plants rather than broadcast application.

In Alternative C, weed infestations would likely spread as a result of fuels treatments. This action would result in a loss of suitable habitat for snails, increasing the risks associated with controlling weeds, such as pesticide application.

Alternative C may adversely impact individuals, but is not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability rangewide.

Specific design criteria for fuels treatments in Spearfish Canyon were developed to minimize impacts to snails. Alternative C is inconsistent with Forest Plan Standard 3103. This alternative would be detrimental to snails (likely within the species stronghold population on the Forest) over an extensive area. Since the proposed treatments may be maintained over the next 10 years and treatments are proposed in known snail habitat and if treatment areas become uninhabitable to snails (which is likely), critical snail habitat on the Forest would be lost and species viability on the Forest "may" be at risk. It is highly likely that individual snails would be lost since treatments would occur on snail colonies and snail microhabitat conditions in Spearfish Canyon would be substantially altered throughout a large percentage of the Canyon bottom. However, it is difficult to justify a determination of "Likely" to result in a loss of viability, since there is insufficient evidence to indicate what level of disturbance snails can or cannot tolerate. In addition, there is lack of survey information on the Forest to support this conclusion. Given the circumstances, it is concluded that, for Cooper's mountain snail, Alternative C "May adversely impact individuals, but is not likely to result in a loss of viability in the Project Area, nor cause a trend to federal listing or a loss of species viability rangewide."

Alternative C - Cumulative Effects

Cumulative impacts would be the same as discussed under Alternative B, with the added impact of additional treatments under Alternative C.

Regal Fritillary (*Speyeria idalia*)

This species was selected as a Sensitive Species due to reductions in its range and declining population trends (USDA-Forest Service 2007e). The primary factor leading to population declines is thought to be conversion of

native tall-grass prairie habitats to cropland and pasture. It is estimated that one-half to two-thirds of the regal fritillary's original range has been converted to cultivated cropland, making it a species that is considered rare range-wide (USDA-Forest Service 2000). Additional threats include habitat alteration from development and fire. Other risks to this butterfly include pine or exotic weed encroachment within prairie meadows, the use of pesticides and herbicides, and grazing by livestock (USDA-Forest Service 1996a).

Habitat and Range

The Black Hills are at the western margin of the regal fritillary's range, possibly due to increased aridity further west (USDA-Forest Service 2000). In South Dakota, the fritillary is most likely to be found in native tall-grass prairies. Continuous prairie greater than 1,000 acres may be required for stable populations (Royer and Marrone 1992). In smaller habitat patches, individuals will move in and out depending on habitat condition and size (Royer and Marrone 1992, USDA-Forest Service 2000b). Adult females of the species lay eggs near violets. After hatching, the first stage larvae crawl to ground cover, where they over-winter. During the following spring, the larvae feed exclusively on violet leaves. By late June or early July, juveniles transform to adults (Royer and Marrone 1992). Adults require a continuous source of nectar-producing flowers such as coneflowers, fleabanes, and thistles (Royer and Marrone 1992).

Occurrence in and Near the Project Area

The Black Hills is primarily forested, and contains relatively small patches of habitat. The best habitats within the Black Hills occur in lower elevation prairies along the outer Forest boundary and in interior meadows, although tall-grass species are not predominant in the interior meadows (USDA-Forest Service 1996a). Forest-wide, there are less than 24,000 acres of prairie or grasslands that are at least 250 acres in size (USDA-Forest Service 1996a). Projects across the Forest have been emphasizing meadow and grassland restoration through removal of pine encroachment. Some of this, particularly pine removal on the periphery of prairies, may contribute to habitat enhancement for the regal fritillary.

Regal fritillary has been identified in the Project Area (USDA-Forest Service 2007c). Potential habitat exists on 748 acres of grassland habitat, although the small size of many patches may limit their suitability.

Environmental Consequences for Regal Fritillary

Alternative A

This species has been associated with wet meadows and riparian areas in the Black Hills. Riparian habitat would not be enhanced under this alternative. Loss of native plants in riparian areas could impact this species as larvae have specific food requirements. Also, no meadow enhancement would take place and it could be reasonably expected that pine would continue to encroach into meadow areas.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Direct effects from Alternatives B and C on the regal fritillary include limited potential individual mortality due to prescribed burning and other management activities in meadows. Long-term, prescribed burning could positively affect regal fritillaries by maintaining native grassland communities and preventing the conversion to shrubs, trees, or undesirable non-native plants. Standards and guidelines in the application of prescribed

burning activities in regal fritillary habitat is provided in the Forest Plan, which prompts butterfly surveys prior to fire use and mandates that no more than 60 percent of any contiguous grassland be burned at any one time. Project specific prescribed fire design criteria incorporate these standards and guidelines. In addition, design criteria call for avoidance of surface disturbing actions such as roads, landings and skid trails in meadows. This criterion should minimize the effects of other management related activities on the regal fritillary.

Alternatives B and C may adversely impact individuals, but are not likely to result in a loss of viability in the Project Area, nor cause a trend towards federal listing or a loss of species viability range wide. At the Forest level, habitat is expected to be maintained through grassland objectives. Alternatives B and C would work toward these objectives.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of Alternatives B and C combined with the past, present and reasonably foreseeable future actions would result in maintenance or enhancement of the grassland habitat within the Project Area. Cumulative effects to regal fritillary are likely to follow the habitat changes, but due to limited suitable habitat on the Project Area, no population changes are expected due to activities.

Privately owned lands within and adjacent to the Project Area may also provide suitable habitats for the regal fritillary. Actions on private land may add to cumulative impacts. Haying and housing likely render habitat unsuitable, whereas grazing may maintain suitability depending on intensity.

Overall, effects from all sources have likely reduced suitable habitat for the regal fritillary. However, because some activities (e.g., grazing, prescribed fire) do not necessarily reduce habitat, there is likely to be sufficient suitable habitat across the landscape that would remain suitable and accommodate use by this butterfly.

3.5.6 Species of Local Concern (SOLC)

Forest Service Region 2 defines SOLC as species documented or suspected to be at risk at a local scale within Region 2, but do not meet the criteria for regional Sensitive Species designation.

Tables 28, 29 and 30 present a list of those SOLC that are known to occur, or whose habitat occurs, within the Project Area. Several other SOLC are found on the Forest, however, their habitats are not found in the Project Area. Risk analyses are completed for those species that occur, or whose habitat may be impacted by the project. The SOLC evaluated in the *Wildlife/Fisheries Resource Report* (JW Associates 2008c) are presented in Tables 28, 29, and 30.

3.5.7 Migratory Birds and Birds of Conservation Concern (BCC)

Many species of migratory birds are of international concern due to naturally small ranges, loss of habitat, observed population declines and other factors. The Black Hills National Forest recognizes the ecological and economic importance of birds. Monitoring of migratory birds is designed and conducted by the Rocky Mountain Bird Observatory (RMBO) Monitoring helps assist the Forest in determining whether additional conservation measures are necessary.

The US Fish and Wildlife Service's Birds of Conservation Concern (BCC) partitions North America into 37 bird conservation regions (BCR). 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 are evaluated in the Biological Evaluation (BE) if they have potential to occur in the Black Hills. Nine 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 one mile of) the Project Area and are evaluated in the BE. The BCCs evaluated in this EIS are presented in Table 29.

Table 29. Evaluation and Description of Black Hills National Forest Bird Species of Local Concern (SOLC) and Birds of Conservation Concern and their Habitats

Species	Status	Species Documented in Project Area?	Rationale
American Dipper (*Cinclus mexicanus*)	SOLC	Yes	Swift-flowing montane stream; Spearfish Creek and its tributaries are only creeks in Black Hills capable of supporting dippers (Beason et al. 2006).
Black-and-White Warbler (*Mniotilta varia*)	SOLC	No	Found primarily in bur oak woodlands and edges, mainly at lower elevations (Panjabi 2001; 2003; 2004, Beason et al. 2006)
Black-billed Cuckoo (*Mniotilta varia*)	BCC	No	Preferred habitat includes low, dense shrubby vegetation (DeGraff et al. 1991); also inhabit open woods, avoiding extremely dense woods and high elevations (Haldeman 1980).
Broad-winged Hawk (*Buteo platypterus*)	SOLC	Yes	Mature and late successional pine and habitat with prominent deciduous component.
Cooper's Hawk (*Accipiter cooperii*)	SOLC	Yes	Ponderosa pine, white spruce, riparian, shrubland, and burned areas (Panjabi 2001; 2002; 2003; 2004).
Golden Eagle (*Aquila chrysaetos*)	BCC	No	Open country, from barren areas to open coniferous forests, primarily in hilly or mountainous regions. Prefers to nest on cliff ledges but will occasionally use trees.
Northern Saw-whet Owl (*Aegolius acadicus*)	SOLC	Yes	Forest habitat generalist; dense coniferous or mixed forest; prefers conifer stands and willow thickets for roosting;hunt along edges or openings (Johnson and Anderson 2003).
Prairie Falcon (*Falco mexicanus)*	BCC	No	Nests on cliffs from low outcrops to tall vertical cliffs over 400 feet (Tallman et al. 2002) Hunting occurs in open areas (DeGraff et al. 1991).
Pygmy Nuthatch (*Sitta pygmaea)*	SOLC	No	Mature pondersoa pine stands with large trees and snags (USDA-Forest Service 2005a).
Red-naped Sapsucker (*Sphyrapicus nuchalis*)	BCC	No	Occurs in aspen or mixed pine-aspen stands (DeGraff et al. 1991).
Sharp-shinned Hawk (*Accipter striatus*)	SOLC	Yes	Variety of forest areas; nesting habitat typically restricted to dense young conifer stands (USDA-Forest Service 2005a).

Table 30. Evaluation and Description of Black Hills National Forest Mammal SOLC and Habitats

Species	Status	Species Documented in Project Area?	Rationale
Long-eared Myotis (*Myotis evotis*)	SOLC	Yes	Mostly coniferous montane habitats; roosts in snags; no known hibernacula in Black Hills (USDA-Forest Service 2005a).
Long-legged Myotis (*Myotis volans*)	SOLC	Yes	Primarily montane coniferous forests; uses caves and mines as hibernacula; roosts in abandoned buildings, rock crevices, under bark. In Black Hills, occurs primarily between 4,500 and 6,500 feet (Schmidt 2003b).
Northern Myotis (*Myotis septentrionalis*)	SOLC	No	Dense ponderosa pine and mixed coniferous/deciduous forest (Luce et al. 1999). Roosts in caves, mines, tunnels, under bark of snags. In Black Hills, occurs primarily between 4,000 and 6,500 feet (Schmidt 2003c)
Small-footed Myotis (*Myotis ciliolabrum*)	SOLC	No	Variable habitats, but usually associated with rocky areas like bluffs, dissected breaks, ridges, cliffs and major rock outcrops. Roosts include mines, caves, rock features and under bark (USDA- Forest Service 2005a).
Meadow Jumping Mouse (*Zapus hudsonius*)	SOLC	No	Strongly associated with riparian habitats along small streams in meadows (Luce et al. 1999)
Mountain Goat *(Oreamnos americanus)*	SOLC	Yes	Rugged terrain with cliffs, rock faces, ledges and talus slopes. Limited primarily to Black Elk Wilderness Area and Norbeck Wildlife Preserve (USDA-Forest Service 2005a).
Northern Flying Squirrel (*Glycomys sabrinus*)	SOLC	Yes	Cool, moist, mature forest with abundant standing and down snags; typically dominated by conifers or mixed coniferous/ deciduous forests (Wells-Gosling and Heanery 1984)

Table 31. Evaluation and Description of Black Hills National Forest Invertebrate SOLC and Habitats

Species of Local Concern	Status	Species Documented in Project Area?	Rationale for carrying or not carrying species forward into NEPA document
Atlantis Fritillary Butterfly *(Speyeria atlantis pahasapa)*	SOLC	Yes	Prefer wet meadows and boggy areas near springs and headwaters of small streams (Marrone 2005).
Tawny Crescent Butterfly *(Phyciodes batessi)*	SOLC	Yes	Open meadows and riparian woodlands (Stefanich 2001). Refer to effect analysis.
Callused Vertigo Snail *(Vertigo arthuri)*	SOLC	No	Moist, relatively undisturbed forest with diverse understories, deep litter and abundant woody material (Frest and Johannes 2002). Calcareous or schist soils.
Frigid Ambersnail *(Catinella gelida)*	SOLC	No	Limestone soils, usually in open ponderosa pine forest (sometimes spruce), often with a secondary deciduous tree and shrub component (Frest and Johannes 2002).
Mystery Vertigo Snail *(Vertigo paradoxa)*	SOLC	No	On limestone or schist soils. Usually in spruce forests (sometimes pine) with relatively closed canopy, abundant litter and well-developed understories (Frest and Johannes 2002).
Strait Disc Snail *(Discus shimekii)*	SOLC	Yes	Found in litter of rich mesic forests with limestone soils, gnerally on shaded, north-facing slopes; often bordering stream flood plains (Frest and Johannes 2002).

American Dipper (*Cinclus mexicanus*) - Species of Local Concern

Habitat and Range

The American dipper occurs from Alaska south along the Pacific Coast to Panama and inland mountain ranges of the west (Kingery 1996). The Black Hills population is at the eastern edge of its global distribution (Panjabi 2001). It is not considered migratory, but movements within or between drainages are common near open, moving water during the freeze-up months of winter (Anderson 2002). The dipper inhabits clear, fast-flowing streams. It feeds primarily on aquatic insects and insect larvae that it catches by diving underwater. Dippers nest within 25 feet of a stream (Anderson 2002) on rocky streamside ledges and cliffs, boulders, behind waterfalls, and under bridges. During winter, dippers move to areas of open water and may move to lower elevations (Anderson 2002).

Occurrence in and Near the Project Area

Spearfish Creek and its tributaries are considered to be the only creeks left in the Black Hills capable of supporting a self-sustaining population of dippers (Backlund 2005). At the Forest-level, the dipper population on the Black Hills is declining and the species was listed as state threatened in 1996 (Backlund 2006). Annual monitoring along Spearfish Creek began in 1993. Based on information from Lovett (2007), nesting attempts in

Spearfish Creek have remained fairly stable over the last three years. Additional monitoring is needed to determine long-term trends on Spearfish Creek.

Spearfish Creek and its tributaries contain nesting habitat for the American dipper. Twenty-seven miles of Spearfish Creek runs through the West Rim Planning Area, along with 5.53 miles Iron Creek, a Spearfish Creek tributary. Spearfish Creek and its tributaries are a stronghold for dippers in the Black Hills.

Environmental Consequences

Alternative A

Ongoing activities in the Forest and adjacent private lands that degrade water would continue to be the primary risk factor for dippers. There is a higher risk of high intensity wildfire in the headwaters of Spearfish Creek with this alternative compared to the other alternatives. Should a large wildfire occur in the headwaters of Spearfish Creek, an increase in sediment and degradation of water quality in the creek would potentially have a negative impact on dipper habitat in Spearfish Creek. Dippers also require sufficient flow to maintain foraging habitat and areas of open water in winter. Flow reductions could increase in the long-term due to drought. This effect, however, would be dependent on local conditions and unknown future events. Any impacts to the dipper population on Spearfish Creek, could have important impacts to the species at the Forest level. This alternative is not likely to impact dippers on Spearfish Creek

Alternative B (Proposed Action) - Direct and Indirect Effects

Potential direct effects to American dippers include noise disturbance from fuel reduction treatments along Spearfish Creek adjacent to nesting areas. However, since the noise associated with water flowing is likely to muffle out most of the noise, and since dippers are relatively tolerant to human activities, it is likely that treatment activities would not cause dippers to abandon nest sites. No direct effects are anticipated from timber harvest activities or road maintenance/construction activities since these activities would not occur in dipper habitat.

Sedimentation and pollution could destroy the habitat of dippers, as streams with a heavy sediment load are not suitable dipper habitat and negatively effects their prey base and breeding habitat "An adult dipper may survive on these streams, at least for a short time, but such streams are not capable of supporting a breeding dipper population" (Backlund 2007). In addition, Anderson (2002) states, "Harvesting near waterways used by dippers is likely to have a negative effect on the water quality and the dippers themselves" and "care must be taken to assure that clarity and pH of streams remain acceptable to dippers, perhaps by maintaining uncut buffer strips along streams".

The risk of high intensity wildfire in the headwaters of Spearfish Creek and consequent increases in sediment and degradation of water quality in Spearfish Creek would be reduced in this alternative. Harvesting in the headwaters of Spearfish Creek would reduce the risk of high intensity fires due to the amount of treatment (Table 37) and the types of treatment (*Section 3.4.2 Environmental Consequences for Fire/Fuels)*.

Short-term increases in stream sediment from commercial timber harvesting and road crossing may occur. However, there are no known dipper nests adjacent to proposed stream crossings or timber harvest units so impacts to dipper are not likely to occur. Any potential impacts would be minimized through BMPs, WCPs,

Spearfish Canyon (MA 4.2A) directives and Forest aquatic and riparian objectives. All applicable standards and guidelines are met in the Project Area through the use of specific design criteria. In addition, Forest directives require that streams with Condition Class III watersheds with additional planned stream crossings, such as Lower Spearfish Creek, would have existing CDAs evaluated and repaired, thus reducing total CDAs in the Project Area (JW Associates 2008f).

Fuels treatments along Spearfish Creek could potentially increase sediment input into Spearfish Creek. However, since treatments proposed by Alternative B are intended to remove conifers from hardwood communities, it is likely that the structure and complexity of the existing hardwood community would prevent erosion from occurring on treatment sites. If this assumption is correct, dippers are not likely to be impacted by the proposed fuels treatments in Spearfish Canyon under Alternative B.

Alternative B (Proposed Action) - Cumulative Effects

The direct and indirect effects of Alternative B combined with the past, present and reasonably foreseeable future actions would maintain or enhance aquatic habitat in the Project Area over the long-term. Cumulative effects to American dipper would likely mirror cumulative effects to streams, and riparian and wetland areas.

Riparian habitat within and adjacent to the Project Area has previously been impacted by overuse of livestock, mineral withdrawal and road crossings. Forest Plan standards and guidelines should reduce these impacts on riparian areas in the future. The reduction of CDAs would have a positive cumulative impact on water quality.

Alternative B would reduce the risk of high intensity wildfire. Therefore this alternative would have a lower risk of increased sediment yield to creeks and loss of riparian shrubs due to wildfire.

American dippers can be impacted by natural and anthropogenic factors. Flooding and winter starvation are among the top natural causes of dipper mortality (Anderson 2002). Dipper populations on the Forest have declined since they were first reported. Dams and water diversions have altered pre-European settlement conditions on many of the perennial streams in the Black Hills. Dams, such as the one at Iron Creek Lake, trap sediment and moderate spikes in flow to meet human water demands. These changes would seem to favor dippers in the Project Area, but that is not reflected in the current population. Water release rates could affect winter habitat availability. Urban development continues to increase in the Black Hills. Much of this private development occurs along riparian and stream courses. Increased sedimentation from cattle grazing and road building and pollution from mines also creates problems along creeks that offer potential dipper habitat (Backlund 2001). Recreational activity continues to increase on the Forest and Spearfish Canyon is a popular destination. Anderson (2002) reports dippers are not unduly disturbed by human activity, though there were factors that complicated the results in the study reported.

Alternative C - Direct and Indirect Effects

Direct and indirect effects of Alternative C include all those discussed for Alternative B. Indirect impacts to dippers and their habitat (Spearfish Creak), need to be especially considered for Alternative C, as this alternative proposes more activity in that creek's watershed. As previously discussed, dippers and their prey base (aquatic invertebrates) are very sensitive to changes in water quality.

As in Alternative B, implementation of BMPs and WCPs would minimize long-term impacts to water quality, therefore, stream habitat would be maintained. However, it is likely that, even if all applicable directives are met, some additional sedimentation would enter waterways that support dippers.

Short term sediment input into Spearfish Creek or tributaries to Spearfish Creek could negatively impact dippers depending on the location, the amount of sediment that enters the creek, and the duration and timing of sediment loading. This alternative presents increased concern about impacts to water quality given that fuels treatments (i.e., vegetation treatments and removal of down woody material) would occur within the WIZ and within close proximity to the waters edge of Spearfish Creek. It is reasonable to assume that following fuels treatments, sedimentation would enter the creek in the short-term, primarily in the first one to three years, or until grasses and other plants establish. Even short-term effects, however, can result in negative consequences for the breeding population of dippers. Doug Backlund, Biologist for the SDGFP, has witnessed dipper nesting attempts on sections of Spearfish Creek that are heavily silted. The result is nest failure; the young dippers die at a few days of age, probably due to lack of food (Backlund 2007). Therefore, there is concern about how the dipper population would respond to changes in their breeding habitat (i.e., increased runoff and sediment loading, and potential changes in water temperature and pH following treatment) and how a population as small and isolated as the dipper's in the Black Hills would absorb losses in recruitment while treatment areas stabilize over time.

The risk of high intensity wildfire in the headwaters of Spearfish Creek and consequent increases in sediment and degradation of water quality in Spearfish Creek would be reduced in this alternative. Harvesting in the headwaters of Spearfish Creek would reduce the risk of high intensity fires due to the amount of treatment (Table 37) and the types of treatment (*Section 3.4.2 Environmental Consequences for Fire/Fuels)*.

An additional consequence of the proposed treatments is the spread of noxious weed infestations, which are likely to occur on treated/disturbed sites. Management of noxious weeds is likely to be higher in this Alternative, leading to additional herbicide application adjacent to Spearfish Creak. Literature reviews on American and European Dippers by Anderson (2002) indicate that dippers and their aquatic invertebrate prey species are extremely sensitive to pollutants. Some noted effects include reduced breeding densities and abundance, delayed egg-laying, smaller body and egg laying mass, and an increase in time spent foraging and less time resting.

Alternative C - Cumulative Effects

Cumulative impacts would be the same as discussed for Alternative B, with the added impact of additional treatments proposed by Alternative C.

Black-and-White Warbler (*Mniotilta varia*) - Species of Local Concern

Habitat and Range

The black-and-white warbler breeds in mature deciduous forests of the United States and Canada. The Black Hills is at the edge of the species distribution in the United States. In the Black Hills, the black-and-white warbler uses mature aspen stands, bur oak woodlands and associated edges as well as 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.

Occurrence in and Near the Project Area

This species is considered a rare breeder in the Black Hills. Panjabi (2001, 2003, 2004) detected only a few individuals during surveys in 2001, 2002, and 2003 though not all habitat types were sampled in 2003. There are no population trends available from breeding bird survey routes in the Black Hills in South Dakota or Wyoming (Sauer et al. 2003). The Project Area contains potential habitat for the black-and-white warbler in the riparian areas adjacent to Spearfish Creek and its tributaries.

The greatest impact to this species has been loss of healthy riparian areas and aspen stands due to fire suppression and forest succession. Commercial logging, mechanical thinning, prescribed fire, and wildfires have most likely benefited the species by reducing pine trees and increasing 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.

Environmental Consequences

Alternative A

This species relies on riparian and hardwood habitats. Riparian areas would not be enhanced by this alternative. In addition, forest succession that favors pine over aspen, riparian and oak woodland habitat would be expected to continue, therefore reducing warbler-preferred habitat.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Direct effects of these alternatives on the black-and-white warbler include a low potential for individual mortality due to tree felling and prescribed fire. Indirect effects include potential habitat loss due to logging, thinning, prescribed burning and temporary road construction in mixed pine and aspen, riparian or oak habitat. The proposed treatments would have mostly beneficial effects by decreasing pine cover and encouraging the growth and expansion of aspen across the Project Area, and particularly aspen and oak in riparian habitats. Warbler habitat would especially benefit from the 427 acres of non-commercial hardwood enhancements.

Since Forest Plan standards and guidelines for deciduous forests, hardwoods and riparian areas would be met at the project level through the use of specific design criteria and assuming that Forest-wide objectives are met at the Forest level, this species would continue to persist on the Forest.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of Alternatives B and C, combined with the past, present and reasonably foreseeable future actions would increase aspen habitat and enhance riparian habitat, potentially leading to an increase of populations of black and white warblers within the Project Area. Riparian habitat within and adjacent to the Project Area has previously been impacted by humans through overuse of livestock, mineral

withdrawal and road crossings. Plan standards and guidelines should reduce these impacts on riparian areas in the future.

These alternatives decrease the risk of high intensity wildfire. Therefore this alternative would have a lower risk of increased sediment yield to creeks and loss of riparian shrubs due to wildfire.

Privately owned lands within and adjacent to the Project Area could also provide suitable breeding and migration stopover habitat for the black-and-white warbler. As a general rule, potential black-and-white warbler habitat on private lands would occur across the Black Hills; however, the extent and persistence of such habitats is uncertain. Implementation of Forest-wide goals, objectives, standards, and guidelines would conserve and restore hardwood and riparian habitats in the Black Hills, providing potential habitat for the black-and-white warbler.

Black-billed Cuckoo (*Coccyzus erythropthalmus*) - Bird of Conservation Concern

Habitat and Range

The black-billed cuckoo breeds from Alberta and Montana east to the Maritime Provinces of Canada, and south to northern Texas, Arkansas, and South Carolina. The birds winter in South America. 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. Nests are well concealed by overhanging vegetation, usually in a shrub or low tree branch (DeGraff et al. 1991).

Occurrence in and Near the Project Area

During 2001, a RMBO technician observed two black-billed cuckoos on the Northern Hills District (Panjabi 2003).

Environmental Consequences

Alternative A

This species' preferred habitat is low, dense vegetation and open woods. This Alternative would be likely to increase forest density and decrease the diversity of forest habitat and shrub. These factors would reduce suitable habitat.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Alternatives B and C would likely increase the suitable habitat for the black-billed cuckoo. Pine removal and prescribed burning would be likely to increase diversity and production in the understory, which would benefit this bird. Treatments such as prescribed fire could also increase prey abundance by increasing insect abundance in the short term.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of these alternatives, combined with the past, present and reasonably foreseeable future actions would increase the diversity of habitat in the Project Area, possibly leading to an

increase in populations of black-billed cuckoos. Adjacent areas may also provide habitat that supports populations of black-billed cuckoos.

Broad-winged Hawk (*Buteo platypterus*) and Cooper's Hawk (*Accipter cooperii*) - Species of Local Concern

Habitat and Range- Broad-winged Hawk

The broad-winged hawk breeds from southern Canada south throughout the eastern United States (Bull and Ferrand 1977). They winter in Central and South America (Johnsgard 1990). They are generally associated with dry to wet deciduous, mixed, or occasionally coniferous forests (Johnsgard 1990). The broad-winged hawk is an opportunistic hunter, feeding on a wide variety of prey including amphibians, reptiles, insects, birds, and small mammals (Johnsgard 1990, Stephens and Anderson 2003). They forage in mature to late successional 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 (Powder River Eagle Studies 2000).

Occurrence in and Near the Project Area - Broad-winged Hawk

Although considered rare in South Dakota (Peterson 1995), the species was the second most frequently encountered raptor during surveys in 1996 and 1997 (Powder River Eagle Studies 2000). This hawk is restricted primarily to the northern Black Hills and Bear Lodge Mountains. Of 27 broad-winged hawk nests found on the Forest, 25 were in ponderosa pine while one was in an aspen, and one was in a paper birch tree. Any impact of management on the species would relate primarily to changes in the relative representation of mature and late-successional ponderosa pine structural stages. Since these hawks will forage in a variety of habitat types, foraging habitat has likely remained stable. Motorized traffic may negatively impact nesting habitat.

The Project Area contains potential habitat for the broad-winged hawk. There are 5 historical (1977-1999) broad-winged hawk nests (one outside the Project Area but within ½ mile of it) in the Project Area vicinity. The exact location of the broad-winged nests are unknown and it is unknown if they are currently active (USDA-Forest Service 2007c).

Habitat and Range- Cooper's Hawk

The Cooper's hawk breeds in forested habitat across southern Canada, the continental United States and northern Mexico (Udvardy and Ferrand 1994). The species is a partial migrant, with populations in the northern portions of its breeding range considered more migratory than those to the south (Palmer 1988). The Cooper's hawk is considered a habitat generalist but typically requires wooded areas for nesting (Stephens and Anderson 2002). This bird is known to nest in riparian, conifer and aspen forests as well as ponderosa pine forest (Stephens and Anderson 2002, Ehrlich et al. 1988). Range-wide, most pairs nest in patches of mature forest with moderate-to-high (60 to 90 percent) canopy closure near openings (Stephens and Anderson 2002).

In general, the Cooper's hawk may be more tolerant of human presence and habitat fragmentation than other North American accipiters (Rosenfeld and Bielefeldt 1993). Overall, however, habitat loss or alteration resulting in a loss of suitable nesting habitat, as well as a decrease in prey abundance and availability, are thought to be the most important threats to accipiter species' persistence (Reynolds 1983).

Occurrence in and Near the Project Area - Cooper's Hawk

The Cooper's hawk has been observed in a variety of habitats in the Black Hills, including ponderosa pine, white spruce, riparian, shrubland, and burned area (Panjabi 2001, 2003, 2004, Peterson 1995). The species appears to be widespread but uncommon on the Forest. Bird monitoring over the past 3 years has yielded an average of five sightings per year (Panjabi 2004). Like the broad-winged hawk, any impact of management on the species would relate primarily to changes in the relative representation of mature and late-successional ponderosa pine structural stages. Since these hawks will forage in a variety of habitat types, foraging habitat has likely remained stable. Motorized traffic may negatively impact nesting habitat.

The Project Area contains suitable habitat for the Cooper's hawk. There is one historical Cooper's hawk nest within the Project Area. The specific location and the activity status of the nest are not known (USDA-Forest Service 2007c).

Environmental Consequences - Broad-winged Hawk and Cooper's Hawk

Alternative A

These species are habitat generalists, but rely on mature ponderosa pine habitats for nesting and a variety of habitats for foraging. In ponderosa pine, mature structural stands with greater than 40 percent canopy closure and late successional stands correspond most closely to their nesting habitat preferences. This alternative would likely provide a long-term increase in nesting habitat for these species. However, some foraging habitat would likely decrease as open habitats are encroached upon by conifers. As these species utilize a variety of foraging habitats, this reduction would probably have limited impacts. This alternative would present an increased risk of wildfire and mountain pine beetle outbreaks. Depending on the intensity of these events, parts of the forest could be reverted to early successional stages, enhancing foraging habitat but reducing nesting habitat.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

The direct effects of Alternatives B and C on the broad-winged hawk and Cooper's hawk include a low risk of individual mortality and nest loss or abandonment due to tree felling. Long-term effects include nesting and habitat loss from logging, mechanical thinning, road construction, and prescribed burning. These species would likely have decreased nesting habitat with a reduction in later successional stands in all affected MAs. These alternatives would reduce the amount of dense (greater than 40 percent canopy cover) mature stands by approximately 12,000 acres. However, Forest-wide and Project Area levels of these structural stages exceed the desired condition for all MAs. Foraging habitat should not be substantially affected.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of these alternatives, combined with the past, present and reasonably foreseeable future actions, would decrease mature ponderosa pine habitat, potentially leading to a decrease of populations of broad-winged and Cooper's hawk within the Project Area. Roads could continue to negatively impact these species due to disturbance of nests.

Private land within and adjacent to the Project Area could provide suitable habitat for nesting and foraging. However, the amount and persistence of that nesting habitat remains uncertain.

Golden Eagle (*Aquila chrysaetos*) - Birds of Conservation Concern

Habitat and Range

The golden eagle occurs throughout North America. It is fairly common in the plains of the western continental US, 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. This eagle inhabits open country, from barren areas to open coniferous forests, primarily in hilly or mountainous regions, but is also found in deserts and grasslands. It prefers to nest on cliff ledges, but will occasionally use trees.

Occurrence in and Near the Project Area

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 (Panjabi 2005).

Environmental Consequences

Alternative A

This species relies on open habitats for hunting and cliffs, or occasionally trees, for nesting. Alternative A would likely continue to reduce open areas available for hunting due to forest succession. Nesting habitat would be increased, but this does not appear to be the limiting factor in the Project Area, so overall impacts on the species would be negative.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Aternatives B and C would increase the amount of open habitat, potentially increasing hunting success for the golden eagle. Additionally, a reduction in pine overstory in proposed harvest areas would likely increase horizontal screening cover, providing a long-term benefit (5-25 years) to the prey populations indirectly benefitting the eagle. Creation of additional open habitat within forested areas through prescribed burning could also increase hunting opportunities. Potential nest trees may decrease in treatment units. However, nest trees are not limiting in the Black Hills. Nesting is primarily on cliffs, although nests are occasionally found in trees. Nesting habitat would be maintained by providing adequate numbers of trees across the Project Area.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of these alternatives, combined with the past, present and reasonably foreseeable future actions, would increase open, non-forested areas in the Project Area. This would likely increase hunting habitat and may lead to increasing populations of golden eagles. Adjacent areas may also provide habitat that supports populations for the golden eagle.

Northern Saw-whet Owl (*Aegolius acadicus*) - Species of Local Concern

Habitat and Range

Saw-whet owls occur from Alaska, across most of Canada and into the northern United States (Johnson and Anderson 2003). In the Black Hills, seasonal migration between high and low elevations is likely (Johnson and Anderson 2003). The northern saw-whet owl is a forest habitat generalist found at lower to middle elevations in forested habitat. The highest densities of this species are found in dense coniferous forests and riparian woodlands (Cannings 1993). Nests tend to be in mature and late successional forests (structural stages 4C and 5) in cavities of snags excavated by large woodpeckers (Johnson and Anderson 2003). This species preys on small mammals, particularly deer mice and birds. Deer mice are an important prey species throughout much of its range; however, northern saw-whet owls are opportunistic hunters taking a variety of small mammals and birds (Cannings 1993).

Occurrence in and Near the Project Area

In South Dakota, the northern saw-whet owl is considered an uncommon resident. There are few documented observations of the saw-whet owls on the Forest, possibly because of the birds' nocturnal habits. No local density estimates are available for the Black Hills (Johnson and Anderson 2003). However, according to Panjabi (2005), this species may be fairly common throughout most of the Black Hills forest types. Limits to persistence are most likely tied to the area of mature forests and the availability of nesting cavities within suitable breeding habitats (Johnson and Anderson 2003).

The Project Area contains mature forests and riparian areas that are suitable habitat for the northern saw-whet owl. This species has been documented in the Project Area (USDA-Forest Service 2007c).

Environmental Consequences

Alternative A

This species relies on mature forests and the availability of snags for nesting. It is likely that this alternative would, in the absence of fire, increase nesting habitat in mature, dense forest. There are increased risks from wildfire and mountain pine beetle outbreaks with this alternative. Both wildfire and beetle outbreaks could return areas of the forest in which they occur to early successional stages. Because the area of mature habitat and availability of nesting cavities are limiting for this species in the Black Hills ecosystem, this alternative would improve habitat conditions for this species.

Alternatives B (Proposed Action) - Direct and Indirect Effects

Direct impacts to the northern saw-whet owl include a low risk of individual mortality and nest loss or abandonment due to tree felling. Indirect impacts include nesting habitat loss from logging, mechanical thinning, road construction and prescribed burning. Dense (greater than 70 percent canopy cover), mature and late successional structural stages most closely resemble the preferred breeding and nesting habitat for the saw-whet owl. Alternative B reduces the area of dense, mature ponderosa pine forest by approximately 3,662 acres. However, this structural stage (4C) is currently above Forest Plan desired levels both Forest-wide and within the Project Area, therefore this treatment is likely to retain sufficient suitable habitat and is not likely

to affect populations. Late successional stage habitat would remain stable or slightly decrease in all MAs, with a total decrease of approximately 56 acres. Although the proposed action will not move towards objectives for late-successional forest in the short term, the proposed treatments would help to achieve the long-term desired distribution of structural stages. Foraging habitat would likely remain stable or increase with logging, thinning and prescribed burning providing a variety of prey in diverse habitats.

Snags are an integral part of nesting habitat. Some snags could be lost through logging operations and prescribed burning for safety reasons. Prescribed burning is expected to create more snags than are lost but most of these snags would likely be of a smaller size class.

Management actions would be mitigated by the Forest Plan standards, objectives and guidelines pertaining to snags and by a standard for raptors. These standards and guidelines would be met in the Project Area through the use of specific design criteria. Assuming these objectives and standards are met Forest-wide, suitable habitat would be maintained for saw-whet owls.

Alternative B (Proposed Action) - Cumulative Effects

Fire suppression within the Forest has likely increased nesting habitat Forest-wide. The direct and indirect effects of Alternative B combined with the past, present and reasonably foreseeable future actions would result in a reduction in mature ponderosa pine nesting habitat within the Project Area and adjacent lands (e.g., Citadel Project Area); however, there would remain an abundance of suitable nesting habitat throughout the Forest.

Privately owned forestlands also provide potential nesting and foraging habitat. Landowners could treat forests for lumber or to reduce fire hazard, which could reduce habitat if mature and late successional pine and spruce stands are treated. It is uncertain how this would affect saw-whet owl habitat as the location and intensity of treatments can not be predicted.

Alternative C - Direct and Indirect Effects

Alternative C would include all of the direct and indirect effects discussed for the saw-whet owl for Alternative B. This alternative proposes additional activity in WUI areas. However, most of the WUI areas do not contain mature dense stands that the owl prefers for nesting. Therefore, there would be a negligible to minimal impact to owl habitat. As with Alternative B, management actions would be mitigated by the specific design criteria which implement Forest Plan standards, objectives and guidelines. No known saw-whet owls occur in the Planning Area. Standards would apply if new nests are discovered.

Alternative C - Cumulative Effects

Cumulative impacts would be the same as discussed for Alternative B, with the added impact of additional treatments proposed by Alternative C.

Prairie Falcon (*Falco mexicanus*) - Birds of Conservation Concern

Habitat and Range

The prairie falcon occurs throughout southwestern Canada and the western US. 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.

Occurrence in and Near the Project Area

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.

Environmental Consequences

Alternative A

The prairie falcon relies on open habitats such as grasslands for hunting and cliffs for nesting. There is limited suitable habitat available for this species in the Forest as it is a prairie dependent species. Therefore, although, forest succession could reduce open areas in the Project Area, there are not likely to be any measurable impact on this species.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Alternatives B and C would create more open and diverse habitats, benefiting the falcon and its prey. Initially, treatments would decrease cover. In the short-term, this would likely increase falcon hunting opportunities and success by making prey more vulnerable to detection. Long-term effects include an increase in understory diversity, which would likely enhance prey species populations and survival. This effect also benefits the falcon. There is limited suitable habitat available for this species in the Forest as it is a prairie dependent species. Therefore, measurable effects to the species are not likely.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of these alternatives, combined with the past, present and reasonably foreseeable future actions, would increase open, non-forested habitat in the Project Area. This would provide some enhancement of habitat for the prairie falcon. However, as this species is primarily found in prairies, more suitable habitat is likely found in adjacent areas than in the Project Area.

Pygmy Nuthatch (*Sitta pygmaea*) - Species of Local Concern

Habitat and Range

The pygmy nuthatch subspecies of the Black Hills (Sitta pygmaea melanotis) is found from southern interior British Columbia south throughout the forests of the Rocky Mountain West into Mexico and western Texas (De Graaf et al. 1991). The nuthatch feeds on insects, ants, wasps, moths, beetles, grasshoppers, spiders, and

pine seeds (Ghalambor 2003). Pygmy nuthatches are cavity nesters generally associated with open, undisturbed, mature ponderosa pine forests (Ghalambor 2003, Scott 1979). Degraff (1991) also noted that this species prefers more open park-like stands in lower and middle elevations. An additional habitat requirement is the availability of large snags. The nuthatch is a weak cavity excavator, requiring soft, large snags for nesting and communal winter roost sites (USDA-Forest Service 1996a).

Occurrence in and Near the Project Area

This species is an uncommon resident in the Black Hills with a yearly fluctuating population, sighted more frequently in recent years. Estimates of local abundance are unavailable due to the scarcity of this species and its unpredictable distribution (Panjabi 2003). 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). Snags have declined due to past and current management activities, negatively impacting nesting and roosting habitat. Fuelwood gathering (i.e. illegal cutting of snags) has and will likely continue to negatively impact habitat. The Project Area contains suitable habitat for the pygmy nuthatch, including mature ponderosa pine forest. The pygmy nuthatch has been documented in the Project Area (USDA-Forest Service 2007c).

Environmental Consequences

Alternative A

This species is likely limited by the availability of snags, for nesting sites and winter roosting habitat, and the availability of foraging habitat. This alternative would likely continue a trend of increased stand density further limiting foraging opportunities for this species. However, it is likely that as stands mature, snag habitat for nesting and winter roosting would increase. Increased wildfire risk and beetle killed trees would further increase the number of available snags if stand-replacing events do not occur. As the number of snags increase, snag availability as a limiting factor for the pygmy nuthatch would be less important. However, the increasing lack of structural diversity and associated foraging habitat in the Project Area would be an increasingly negative impact on this species.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

The direct effects of these alternatives include a low risk of individual mortality and nest loss or abandonment due to tree felling. Indirect effects would likely include an increase of open ponderosa pine habitat, due to the removal of mature and immature conifers during commercial logging, mechanical thinning and prescribed burning. Foraging habitat and prey in open pine sites would, therefore, increase (Cerovski 2002, Dykstra 1999). Pygmy nuthatch prefers larger snags in more mature (but not necessarily dense) cover for nesting, generally in mature or late successional stands with less than 40 percent canopy cover. Alternatives B and C would increase preferred nesting habitat by about 4,675 acres. This increase in habitat would occur in MA 4.1, MA 5.1 and MA 5.6. MA 5.4 would experience a slight reduction in preferred nesting habitat.

The increase in nesting habitat is dependent on the retention of large snags. Mature trees, which potentially become snags, would decline in harvested areas. Prescribed burning would create a net increase in snags. However, most of the new snags created through prescribed burning would likely be of a smaller size class than existing snags. Snags could be lost through logging operations, new road construction and safety concerns.

Potential effects would be mitigated by Forest Plan guidelines and objectives pertaining to snags. Forest standards, guidelines and objectives would be met in the Project Area through the use of specific design criteria. Therefore, assuming that progress is made toward meeting structural stage objectives Forest-wide, there would be adequate habitat for the pygmy nuthatch.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of these alternatives, combined with the past, present and reasonably foreseeable future actions, would increase preferred open ponderosa pine habitat. This could lead to an increase of pygmy nuthatch populations in the Project Area. Snags have been reduced in past and current timber harvest activities. Negative impacts of management activities would be avoided by meeting Forest Plan standards for snag retention.

Privately owned forestlands within the Forest boundary also provide potential nesting and foraging habitat. Because the exact placement and intensity of potential treatments on private land is uncertain, it is difficult to predict how pygmy nuthatch habitat would be affected.

Red-naped Sapsucker (*Sphyrapicus nuchalis*) - Birds of Conservation Concern

Habitat and Range

This species occurs from southern British Columbia and Saskatchewan south throughout the western US. It is a common woodpecker found in deciduous and mixed deciduous-coniferous forests. In the Rocky Mountains, it occurs in aspen stands, or in 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.

Occurrence in and Near the Project Area

This 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. They have been observed in hardwood stands of aspen and birch, and mixed pine-aspen stands across the Northern Hills District (Beason et al. 2006).

Environmental Consequences

Alternative A

This species is limited by the availability of hardwood habitat. Alternative A would continue the encroachment of pine and spruce into aspen habitat due to fire suppression and forest succession. Long-term, suitable habitat for the species would be expected to be reduced.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Nest trees and nesting habitat for this species could be decreased by the removal of commercial wood (>9" dbh) in the proposed treatment areas. However, this bird prefers to nest in aspen trees, which are unlikely to

be directly affected by proposed activities. In the long-term, the proposed treatments encourage aspen, potentially increasing the preferred habitat for this species. Timber harvest and thinning could also increase foraging opportunities for this woodpecker by providing down woody material for insects. Prescribed burning could have beneficial impacts to this species by enhancing and expanding aspen stands as well as potentially increasing insect populations that invade dead and dying trees after fires (Cerovski 2002).

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of these alternatives, combined with the past, present and reasonably foreseeable future actions, would increase hardwood habitat in the Project Area, increasing red-naped sapsucker habitat and possibly their populations. Adjacent areas may also provide habitat supportive of populations of red-naped sapsucker. Although private landowners could theoretically remove aspen, which could reduce habitat for the red-naped sapsucker, it is unlikely as aspen is often seen as a desirable species. Overall, if hardwood restoration treatments are successful on the Forest, populations should remain stable or increase in the long-term.

Sharp-shinned Hawk (*Accipter striatus*) - Species of Local Concern

Habitat and Range

The sharp-shinned hawk breeds from Alaska to Newfoundland, south throughout much of North America, Mexico, and into Central and South America (Stephens and Anderson 2003). The species is considered a partial to long-distance migrator, with northern-most individuals wintering in the southern United States. Other birds may remain on their breeding ranges throughout the winter. Although there is a high degree of uncertainty about some of the sharp-shinned hawk's habitat requirements (e.g., stand area, amount of edge, and forest patchiness), young stand age, high tree density, and high canopy closure all seem somewhat important parameters across the species' breeding distribution (Bildstein and Meyer 2000, Bosakowski and Smith 2002). Sharp-shinned hawks primarily forage in the forest canopy (Reynolds 1989) where they non-selectively take a variety of avian prey species (Joy et al. 1994). In the Black Hills they have been documented using spruce, pine and aspen habitats (Panjabi 2003). Nesting habitat appears to be associated with young seral stages with dense canopies (68 percent or higher) (Bosakowski and Smith 2002, Stephens and Anderson 2003).

Habitat loss or alteration resulting in a loss of suitable nesting habitat as well as a decrease in prey abundance and availability are thought to be the most substantial threats to accipiter species' persistence (Reynolds 1983, Stephens and Anderson 2002).

Occurrence in and Near the Project Area

Sharp-shinned hawks were historically common in the Black Hills, (Pettingill and Whitney's 1965). Currently, however, they appear to occur in very low densities (Panjabi 2003). On the Forest, the only documented nests both occurred in white spruce habitat (Stephens and Anderson 2002). On the Forest, there are 800 acres of young white spruce stands with dense canopies, and approximately 113,000 acres of ponderosa pine with dense canopies (USDA-Forest Service 2005a). Mature aspen stands near the nest may be particularly important to the species (Stephens and Anderson 2002), and one sharp-shinned hawk detected during recent surveys was in an aspen stand (Panjabi 2003). There are about 12,000 acres of mature aspen on the Forest. The Project Area

contains mature ponderosa pine forest that would act as suitable habitat for sharp-shinned hawks. This species has been identified in the Project Area (USDA-Forest Service 2007b).

Environmental Consequences

Alternative A

The sharp-shinned hawk uses young seral stage forests with dense canopies. Nesting habitat would likely decrease as stands continue to age and increase in density. Open foraging habitat and associated prey would be likely to decrease. An increased risk of intense wildfire and severe pine beetle outbreaks both have the potential to reduce habitat. Depending on severity, affected areas of the forest could be returned to early successional stages.

Alternatives B (Proposed Action) and C- Direct and Indirect Effects

Direct effects of these alternatives include a low risk of individual mortality and nest loss or abandonment due to tree felling. Long-term, nesting habitat in dense young forest would be expected to increase by about 2,597 acres due to forest thinning and prescribed burning. Foraging habitat in open areas would also be likely to increase, along with the abundance of prey species associated with open habitat. Assuming the Forest Plan objectives are met at the Forest level, sufficient habitat for this species would continue to exist on the Forest.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of these alternatives, combined with the past, present and reasonably foreseeable future actions, would increase dense, young forest habitat, potentially leading to an increase of sharp-shinned hawk populations in the Project Area. Privately owned forestlands within the Forest boundary could also provide nesting habitat. However, the amount and persistence of nesting habitat remains uncertain.

Long-eared Myotis (*Myotis evotis*), Long-legged Myotis (*Myotis volans*), Northern Myotis (*Myotis septentionalis*) and Small-footed Myotis (*Myotis ciliolabrum*) - Species of Local Concern

Bats - Trends and Field Reconnaissance for all Bats

Trend data is not available for bat populations in the Northern Hills. In the Project Area, there is one known cave (Community Cave) and 32 known abandoned mines that contain potential roosting habitat for bats. The extent to which bats are currently using the Project Area is not known. The availability of suitable hibernacula, maternity roosting sites, and foraging areas all represent potential risk factors for bats in the Black Hills (Schmidt 2003d). These bat species hibernate in caves and abandoned mines; human disturbance in or near hibernacula may cause site abandonment and local population losses. Recreational activities, including spelunking, can disturb hibernating bats. Habitat loss can occur with the closure of abandoned mines or destruction of buildings used by bats. Disturbance to cave and mine openings that changes airflow patterns, temperature regimes, and bat access can also impact bats. Timber management or mining activities, particularly the associated loud noise, can also disturb roosting or hibernating bats. Changes in forest structure that reduce the availability of suitable roost snags, particularly larger snags, can negatively affect these bats (USDA-Forest Service 2005a).

Habitat and Range - Long-eared Myotis (Myotis evotis)

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 2003a). 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 (Schmidt 2003a). Potential day and maternity roosts in the Black Hills are found in buildings, rock crevices, snags, under loose bark, caves and mines. Limited data suggest they use ponderosa pine snags as day and maternity roosts in other regions. Moths and beetles are believed to be important prey (Schmidt 2003a).

Occurrence in and Near the Project Area - Long-eared Myotis (Myotis evotis)

The only records of long-eared myotis in the Black Hills has come from unpublished reports (Schmidt 2003a). It is unknown whether the Black Hills supports a self-sustaining population (Schmidt 2003a). Any timber harvest activities that occur close to known roosting sites during the maternity roosting period (July to August) are anticipated to have negative impacts (Schmidt 2003a).

Habitat and Range - Long-legged Myotis (Myotis volans)

The long-legged myotis is common across the western United States, ranging across much of western North America from southeastern Alaska into central Mexico (Schmidt 2003b). It 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 2003b). This bat is primarily associated with montane forest. In the Black Hills, this species occurs primarily at elevations between 4,500 and 6,500 feet (Turner 1974). It forages over meadows, ponds, streams, and open mesic habitats of the Black Hills (Luce et al. 1999, Turner 1974). 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 2003b). Ponderosa pine snags are used as summer/maternity roosts in the Black Hills (Cryan et al. 2001). Moths appear to comprise the majority of this species' diet, and it is known to feed on the spruce budworm moth (Schmidt 2003b).

Occurrence in and Near the Project Area - Long-legged Myotis (Myotis volans)

This species is the most common and widely distributed bat in the Black Hills (Turner 1974). Roosts are generally on south-facing slopes in mature and late successional pine forests. Day roosts are usually under the bark of ponderosa pine and in snags. Hibernating individuals are known to use caves in the Black Hills (Schmidt 2003b, Luce et al. 1999, Turner 1974)).

Habitat and Range - Northern Myotis (Myotis septentionalis)

The northern myotis ranges across most of eastern North America and 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 2003c). 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. Luce et al. (1999) listed habitat associations as dense ponderosa pine and mixed coniferous/deciduous forest. 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 2003c).

Occurrence in and Near the Project Area - Northern Myotis (Myotis septentionalis)

In the Black Hills region, this species has been captured at elevations ranging from 4,000 to 6,500 feet (Schmidt 2003c). Northern myotis have been trapped in the Project Area during wildlife studies (USDA-Forest Service 2007c). Local population trends are not known for this species.

Habitat and Range - Small-footed Myotis (Myotis ciliolabrum)

The small-footed myotis ranges across much of western North America, from central Canada south to the central states of Mexico (Schmidt 2003d). 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 2003d). 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. .

Occurrence in and Near the Project Area - Small-footed Myotis (Myotis ciliolabrum)

The species is widespread but not abundant throughout the Black Hills region and has been captured at elevations ranging from 3,800 feet to 6,000 feet (Schmidt 2003d). This species has not been documented but has suitable habitat in the Project Area. Local population trends are not known for this species.

Environmental Consequences - Long-eared Myotis (Myotis evotis), Long-legged Myotis (Myotis volans), Northern Myotis (Myotis septentionalis) and Small-footed Myotis (Myotis ciliolabrum)

<u>Alternative A</u>

These bat species rely on the availability of snags, rocks, caves or mines for roosting and on a variety of forest habitats for foraging. The continuation of forest succession and fire suppression would limit foraging opportunities by creating dense forests and decreasing hardwood habitats in riparian areas. There are also increased risks from wildfire and mountain pine beetle outbreaks under Alternative A. Wildfire could lead to the loss of roost trees and snags. Pine beetle outbreaks and less intense wildfire could increase snag density.

<u>Alternatives B (Proposed Action) and C - Direct and Indirect Effects</u>

Direct effects on bats include the limited potential for individual mortality due to tree felling. Indirect effects include loss of habitat due to the reduction of suitable roost snags if they are removed due to safety concerns or new road construction. The negative impacts of Alternatives B and C on snags would be mitigated by maintaining all snags in treatment areas except for those that pose a safety hazard. It should be noted that some snags may be lost along corridors were news roads are being constructed.

Alternatives B and C would likely improve foraging habitat for bats, due to meadow enhancement and opening of pine stands. Additionally, insect populations may increase after prescribed fires (Cerovski 2002), and logging and thinning (Dykstra et al. 1999), increasing available bat prey. Fuel mitigation treatments (removal of small diameter conifers from hardwoods) in Spearfish Canyon would likely benefit hardwood communities, providing additional foraging habitat. No bat hibernacula have been identified in Spearfish Canyon, however surveys are lacking. Hibernating bats along the cliff walls and caves could be impacted by the smoke that is

generated by burning slash piles. To minimize impacts to hibernating bats, there would be no pile burning in the Canyon if smoke inversions are likely, thereby reducing the likelihood that bats would suffer impacts from smoke inhalation.

Community Cave is the only known cave in the Project Area. Due to limited surveys, the importance of mines in the Project Areas as hibernacula or maternity roosting sites is not known. No hibernacula or roosting sites have been discovered, but suitable habitat is likely to exist. Thirty-two abandoned mines, have been identified using District archeological data. Bat surveys at these sites have not been conducted, therefore bat use is unknown. To assure protection of potentially sensitive bat habitat, the following design criteria was developed: No treatments would be conducted within 500 feet of adit portal or shaft openings of mines or caves to maintain microclimate of bat hibernacula or nurseries, unless it is determined though bat surveys that the site is not bat roost habitat. Bat surveys and bat survey protocols must be pre-approved by the district wildlife biologist and surveys must be conducted prior to implementation to determine if the site needs protection, and to what extent, or else a 500 foot no treatment zone would apply around the opening. Should any sites be discovered in the Project Area, protection would also be provided by the above design criteria.

Alternatives B (Proposed Action) and C - Cumulative Effects

As the location and size of bat roosts in the Project Area are not known, specific cumulative impacts are difficult to determine. Based on habitat preference, the direct and indirect effects of these alternatives, combined with the past, present and reasonably foreseeable future actions, would decrease roosting habitat and increase foraging habitat, leading to stable or slightly declining populations of bats within and adjacent to the Project Area. Privately owned lands within and adjacent to the Forest boundary may also provide suitable bat habitat; however, the extent and persistence of such habitat is uncertain.

Meadow Jumping Mouse *(Zapus hudsonius)* - Species of Local Concern

Habitat and Range

The meadow jumping mouse is found across portions of Alaska, throughout Canada and in the northern and eastern United States (Higgins et al. 2000). Within the 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). This species also occurs in western South Dakota and southeastern Montana. This species is associated with marshy areas and moist grasslands near streams, coniferous and deciduous forests, mixed shrublands and riparian shrublands (Cerovski et al. 2004). The meadow jumping mouse retreats to burrows in dry ground from October to May. Diet includes grasses, grass seeds, fungi, buds, berries, leaves, nuts, and insects (Luce et al. 1999).

Occurrence in and Near the Project Area

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 (Luce et al. 1999). Fragmentation of appropriate riparian habitat may limit this species' ability to disperse. Riparian habitat is available on

Spearfish Creek and its tributaries in the Project Area. This species has not been documented in the Project Area.

Environmental Consequences

Alternative A

The meadow jumping mouse relies on understory shrubs, grasses and forbs in riparian areas. Alternative A does not enhance riparian habitat. This alternative has an increased risk of wildfire and mountain pine beetle outbreaks. These events could have negative short term impacts on jumping mice but could, in the long-term, increase understory habitat.

Alternative B (Proposed Action) - Direct and Indirect Effects

Direct effects to the meadow jumping mouse include the slight potential for individual mortality due to fuel reduction treatment in Spearfish Canyon. These thinning treatments may also have short-term negative impacts by reducing hiding cover. Long-term effects would increase the amount of habitat available for the species. Thinning of conifers in Spearfish Canyon would lead to the development and expansion of hardwood stands and grasslands in riparian areas, providing additional jumping mouse habitat.

The effects of management activities upon riparian areas are mitigated through a wide variety of standards and guidelines, as well as BMPs and WIZ protection measures. These standards and guidelines are met in the Project Area through the use of specific design criteria. If these standards and guidelines are met throughout the Forest, then the meadow jumping mouse would persist on the forest.

Alternative B (Proposed Action) - Cumulative Effects

The direct and indirect effects of Alternative B, combined with the past, present and reasonably foreseeable future actions, would enhance riparian habitat, potentially leading to increasing meadow jumping mouse populations within the Project Area. Adjacent areas may also provide habitat that supports jumping mouse populations.

Limitations on management actions and movement toward riparian habitat objectives would have a positive additive impact on maintaining habitat for this species. Private in-holdings occur frequently within riparian areas. These private lands provide suitable habitat, but conditions may have been altered by private land management activities such as livestock grazing or draining to convert to drier site conditions for subsequent haying. Efforts to conserve and enhance riparian habitat for this species on the Forest may be constrained by habitat conditions on adjacent non-NFS lands.

Alternative C - Direct and Indirect Effects

The meadow jumping mouse is strongly associated with riparian habitats along small streams in meadows and habitats beneath forests with an understory of deciduous shrubs, grasses, forbs, and fallen logs and is presumed to disperse primarily along stream corridors (USDA-Forest Service 2005a). It should be noted that fuels treatments in Spearfish Canyon do not include removal of hardwoods and any positive response from hardwood species to proposed treatments may benefit the species. However, fuel reduction treatments in Spearfish Canyon are likely to have negative impacts to meadow jumping mouse habitat by reducing the

amount of hiding cover, a result of the loss of downed vegetation and understory vegetation. In addition, there would likely be an increase in noxious weed infestation on sites disturbed by treatment activities.

Forest Standards 2307 and 2308 requires the retention of at least 100-linear-feet per acre of coarse woody debris that is a minimum of 10 inches in diameter in conifer-forested areas. Standard 3117 requires that any harvest activities maintain at least one pile of woody material every two acres, except within 300 feet of buildings. Project Area design criteria were developed to meet down woody material standards and guidelines. However, since most of the proposed fuels treatments would occur within 300 feet of buildings, most piles created from fuels treatments would be burned. Some down woody material would be retained, so although reduced, this important habitat component would not be entirely lost. Alternative C may negatively alter meadow jumping mouse habitat and dispersal corridors, which may make treatment areas less suitable for the species.

Alternative C - Cumulative Effects

Cumulative impacts would be the same as discussed under Alternative B with the added impact of additional treatments under Alternative C.

Northern Flying Squirrel *(Glaucomys sabrinus)* - Species of Local Concern

Habitat and Range

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. The northern flying squirrel in the Black Hills is an isolated population; the nearest population is located in the forests of western Wyoming (Higgins et al. 2000, 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 (NatureServe 2006). In the Black Hills, its preferred habitat is most likely white spruce and open ponderosa pine. Northern flying squirrels typically nest in tree cavities or abandoned woodpeckers holes in winter and summer. They use hollow trees, cavities, abandoned woodpecker holes, or dense portions of trees as nest sites (Wells-Gosling and Heaney 1984). They feed on lichens, fungi, conifer cones, fruit, buds, arthropods, bird eggs and nestling birds (Cerovski et al. 2004).

Occurrence in and Near the Project Area

There is a lack of specific data on habitat use by northern flying squirrels in the Black Hills. Spruce habitat is patchily distributed and in low abundance (USDA-Forest Service 2005a), but appears to be increasing. Ponderosa pine may also provide habitat for flying squirrels. This species has been found 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, but stands of dense dog hair pine were avoided (Duckwitz 2001).

The Project Area contains mature ponderosa pine forest that is suitable habitat for the northern flying squirrel. This species has been observed in the Project Area (USDA-Forest Service 2007c).

Environmental Consequences

Alternative A

The preferred habitat for the northern flying squirrel is white spruce and mature, open ponderosa pine stands with snag availability. Due to continued fire suppression, Alternative A would be expected to increase white spruce habitat within suitable habitat. Continued forest succession, however, would decrease open ponderosa pine habitat. Snags are expected to increase with increased forest density. This alternative has an increased risk of wildfire and mountain pine beetle outbreaks. These events would reduce snags in some parts and increase them in others. Overall, habitat for this species is expected to remain stable.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Direct effects of Alternatives B and C on the northern flying squirrel include a low risk of individual mortality due to tree felling. Timber harvest activities that occur within occupied flying squirrel nesting habitats during the nesting season could directly displace, harm, or kill young, non-mobile flying squirrels.

Mature ponderosa pine habitat with less than 40 percent cover would increase in MAs 4.1, 5.1, and 5.6. There would be a slight decrease in this habitat in MA 5.4. Late successional habitat, which may include open ponderosa pine habitat, would remain stable or slightly decrease in all MAs. No progress would be made towards structural stage objectives for late successional stands in the short-term.

Overall, these alternatives would increase mature, open ponderosa pine habitat. The flying squirrel also prefers spruce habitat. Although there may be some reduction in spruce habitat in the Project Area, spruce are not specifically targeted for removal and its area would be maintained by Objective 239-LVD.

Flying squirrels require sufficient standing and downed snags. Prescribed burns would likely destroy some current snags but also create new snag habitat, with a net increase. Specific design criteria in the Project Area would follow Forest Plan standards and guidelines pertaining to snags.

Alternatives B (Proposed Action) and C - Cumulative Effects

The direct and indirect effects of these alternatives, combined with the past, present and reasonably foreseeable future actions, would increase mature, open ponderosa pine habitat and a potentially increase snags. Therefore, northern flying squirrel populations are expected to remain fairly stable within the Project Area over the next 20 years.

Privately-owned lands within and adjacent to the Project Area may also provide suitable northern flying squirrel habitat, however, the extent and persistence of such habitat is unknown (USDA-Forest Service 2005a). Private lands managed for timber harvest may tend toward less area in the late successional stage forest and fewer snags.

Atlantis Fritillary *(Speyeria atlantis pahasapa)* and Tawny Crescent *(Phyciodes batessi)*- Species of Local Concern

Butterflies - Species of Local Concern - Trends

The loss of native plant species, particularly around water sources has caused a decline in habitat for this species (Marrone 2005). Conifer encroachment into hardwoods, meadows and riparian areas due to fire suppression has also reduced their habitat. Livestock overgrazing in riparian 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.

Habitat and Range - Atlantis fritillary

The Atlantis fritillary is associated with riparian areas adjacent to openings and moist meadows and in boreal forests (NatureServe 2004). In the Black Hills, this subspecies is restricted to Custer, Lawrence, and Pennington counties in South Dakota (Marrone 2002). It prefers wet meadows and moist canyons such as those near Dalton Lake and Lakota Lake (Marrone 2002). It is assumed that habitat requirements and preferences are similar to other species of this genus. 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).

Occurrence in and Near the Project Area - Atlantis fritillary

There are currently no reliable estimates of the Black Hills Atlantis fritillary population (NatureServe 2004). Management activities may indirectly affect this species by modifying the quality or extent of riparian habitat. Due to the restricted nature of the Atlantis fritillary's distribution in the Black Hills, development or management activities within suitable habitats pose a risk to long-term persistence. Much of the fritillary's habitat is privately owned (USDA-Forest Service 2005a).

Wet meadow and riparian areas in the Project Area may contain suitable habitat for the Atlantis fritillary. This species was recorded in the Fauna database. One male specimen was found during surveys in a mixed conifer stand adjacent to a wet meadow (Marrone 2005, Lovett 2006).

Habitat and Range - Tawny Crescent

The tawny crescent is found in open meadows, stream bottoms, roads, trails, and riparian woodlands (Stefanich 2001). It is also found in mesic forest corridors in mixed-grass meadows or prairie grasslands adjacent to woodlands (Royer and Marrone 1992a). Moist meadow or grassland habitats along forest or woodland edges are characteristic of this species (Royer and Marrone 1992a, Stefanich 2001). Tawny crescent larvae appear dependent on asters as a food source although the specific host species and their relationship remain unclear (Stefanich 2001).

Occurrence in and Near the Project Area - Tawny Crescent

The populations of tawny crescent inhabiting the Black Hills of South Dakota and Wyoming are considered genetically isolated and disjunct from crescents found elsewhere (Royer and Marrone 1992a). Reliable estimates of local abundance or population estimates for tawny crescent in the Black Hills are lacking (Stefanich 2001). Distinguishing this species from the northern pearl crescent and the field crescent is

extremely difficult, and the potential for hybridization between these species has not been resolved (Stefanich 2001). Stefanich (2001) hypothesized that the only limiting factor in the Black Hills is the destruction of this butterfly's habitat or isolation of colonies to the extent that populations are unable to disperse.

There are eleven tawny crescent sightings in the Project Area according to the West Rim fauna database. Notes indicate that one specimen was collected in a riparian area and another on a wet road (USDA-Forest Service 2007c).

Environmental Consequences - Altlantis Fritillary and Tawny Crescent

Alternative A

These species have been associated with wet meadows and riparian areas in the Black Hills. Alternative A does not enhance riparian habitat. The continued loss of native plants in riparian areas could impact these species as larvae have specific food requirements.

Alternatives B (Proposed Action) - Direct and Indirect Effects

The direct effects of Alternative B to butterflies include a low risk of individual mortality due to prescribed burns. Long-term, Alternatives B would enhance meadows and riparian areas by reducing the encroachment of pine.

Actions would be guided by Forest Plan standards and objectives relevant to riparian areas and wet meadows. In addition, guidelines specific to butterfly protection would reduce direct effects on this species. These guidelines include restricting the burn schedule to consider butterfly habitat needs. No more than 60 percent of a meadow is to be prescribed burned in early spring or fall. In the Project Area, these standards and guidelines would be met through the use of specific design criteria. If standards for butterflies and riparian and meadow habitats are met Forest-wide, these species can be expected to persist on the Forest.

Alternative B (Proposed Action) - Cumulative Effects

The direct and indirect effects of Alternative B, combined with the past, present and reasonably foreseeable future actions, would enhance wet meadow and riparian habitat in the Project Area, potentially leading to increased populations of these butterflies in the Project Area. Adjacent areas may also provide habitat.

Additionally, privately owned lands within the Forest boundary likely provide suitable habitat, but the extent of the habitat and how long it would persist is uncertain. The achievement of riparian habitat objectives would have a positive impact on maintaining habitat for these species. Private in-holdings occur frequently within riparian areas. These private lands provide suitable habitat, but conditions may have been altered by private land management activities, such as livestock grazing or draining to convert to drier site conditions for subsequent haying. Efforts to conserve and enhance riparian habitat for these species on the Forest may be constrained by habitat conditions on adjacent non-NFS lands.

Alternative C - Direct and Indirect Effects

Known occurrences of tawny crescent and Atlantis fritillary do not occur within proposed treatment sites. However, SOLC butterfly habitat is likely to occur in Spearfish Canyon. Alternative C could disturb riparian areas due to timber harvest activities. Pile burning could negatively impact butterflies if it occurs in suitable

habitat. However. in the long-term, thinning of conifers could increase suitable butterfly habitat by creating more open canopy. The overall increase in area would be minimal. Assuming that riparian objectives are met at the Forest level, it is expected that there would be little impact to tawny crescent and Atlantis fritillary populations on the Forest if this alternative was implemented.

Alternative C - Cumulative Effects

Cumulative impacts would be the same as discussed under Alternative B, with the added impact of additional treatments under Alternative C.

Callused Vertigo Snail *(Vertigo arthuri),* Frigid Ambersnail *(Catinella gelida),* Mystery Vertigo Snail *(Vertigo paradoxa)* and Striate Disc Snail *(Discus shimekii)* - Species of Local Concern

Trends and Field Reconnaissance for all SOLC snail species

Land snails, in general, are susceptible to habitat changes that increase sun exposure, disturb ground cover, reduce microsite humidity, or compact the soil. Additional risks include direct loss of habitat, barriers to dispersal (e.g., roads), predation, trampling by grazing ungulates, timber harvest, intense wildfire, application of herbicides or pesticides, and toxic leachates from mining activities (Frest and Johannes 2002).

Frest and Johannes conducted surveys in 1991, 1993 and 1999 for sensitive snail species in the Black Hills (Frest and Johannes 2002). This data, along with snail information collected during botany surveys and by USFS biologists were used to identify known snail habitat in the Project Area. However, Frest and Johannes sampled only a fraction of the Project Area. It should be noted that it is common knowledge that snail colonies exist throughout a large portion of Spearfish Canyon, despite the fact that survey data is limited to only a small percentage of the area (USDA-Forest Service 2007c).

Habitat and Range - Callused Vertigo Snail

The callused vertigo is found in a narrow geographic range including South Dakota, Wyoming, North Dakota, Minnesota, and Alberta (Frest and Johannes 2002). In the Black Hills, callused vertigo have been found in wet, relatively undisturbed forest, most often white spruce or ponderosa pine with a varied understory. This habitat includes closed-canopied white spruce and ponderosa pine ecosystems. Associated understory vegetation species identified by Frest and Johannes (2002) are representative of the high elevation riparian-forest ecological group (Marriott and Faber-Langendoen 2000) indicating callused vertigo is also associated with the riparian and hardwood ecosystems. Essential habitat features include limestone or schist substrate, shaded forest floor, deep organic surface litter, downed logs, and mesic site conditions. These components are requirements for suitable callused vertigo habitats.

Occurrence in and Near the Project Area - Callused Vertigo Snail

Callused vertigos were found sparingly at a total of 63 of the 357 sites inventoried/monitored (Frest and Johannes 2002). The species was mostly found at sites with high mollusk concentration, including mystery vertigo, striate disc, and Cooper's mountainsnail (Frest and Johannes 2002). Occurrence has not been documented in the Project Area, however suitable habitat exists in Spearfish Canyon.

Habitat and Range - Frigid Ambersnail

The frigid ambersnail is currently found only in Iowa (14 sites), South Dakota (12 sites), and Wisconsin (Frest and Johannes 2002). In the Black Hills, they were most often found in rather open ponderosa pine forest, often with a secondary deciduous tree and shrub component, although white spruce was a minor component at a few sites. The species was usually found on limestone but also on schist soils, and colonies were often found in somewhat dry wooded limestone talus, generally near the slope base.

Occurrence in and Near the Project Area - Frigid Ambersnail

According to surveys in the Black Hills by Frest and Johannes (2002) the frigid ambersnail was rare at all locations, and very few live adults were observed during the early 1990s surveys. Locations are widely distributed geographically across the Forest at varying elevations (3,800 to 6,800 feet). The frigid ambersnail was found to co-occur with Cooper's mountainsnail and rarely with the callused vertigo and striate disc. Nekola (2003) considered this species a "duff specialist." Duff specialists were strongly affected by human activities, suggesting that protecting soil and surface characteristics are important in their conservation. Occurrence has not been documented in the Project Area, however suitable habitat exists in Spearfish Canyon.

Habitat and Range - Mystery Vertigo Snail

The mystery vertigo is rare in the United States and occurs only in South Dakota (21 sites); Wyoming (2 sites in the Bear Lodge Mountains); Michigan (1 site); Maine (2 counties); and a few northern Wisconsin, Michigan, and Minnesota sites (Frest and Johannes 2002). In general, this species occurs in forest habitats and prefers duff soils with a substantial layer of organic matter (Anderson 2004b). They can be found under fallen logs and leaves, and aspen may also provide suitable habitat (Anderson 2004b).

Occurrence in and Near the Project Area - Mystery Vertigo Snail

In the Black Hills, Mystery vertigos were found at 23 of the 357 sites inventoried/monitored. They were not generally abundant at any site. All sites with mystery vertigo were in the central or northern Black Hills or the Bear Lodge Mountains (Frest and Johannes 2002). The species was found to be associated with the closed-canopied white spruce and ponderosa pine ecosystems. Sites generally had well developed litter and a rich understory and were found at the base of a wooded, north-facing slope on limestone or schist substrates. Down woody material is an important habitat element. Mystery vertigo was not common in taluses but could be found crawling on rock surfaces in moist weather and appears to feed on the organic coating of rock surfaces and partially decayed leaves. Associated snail species include callused vertigo, cross vertigo, Cooper's mountainsnail, and striate disc. Occurrence has not been documented in the Project Area, however suitable habitat exists in Spearfish Canyon.

Habitat and Range - Straite Disc Snail

The range of the striate disc includes Wyoming (2 sites), Montana (1), Colorado (perhaps 26 sites), South Dakota, Oregon (1), California (2), Utah (5), Arizona (3), and New Mexico (7) (Frest and Johannes 2002). Hendricks (2003) also lists 5 records in Montana. Live sites have also been reported from several Canadian provinces.

Occurrence in and Near the Project Area - Straite Disc Snail

In surveys by Frest and Johannes (2002) in the Black Hills, the striate disc snail was most often found in litter in rich mesic forest, generally on shaded, north-facing slope bases, often bordering stream floodplains. They were locally abundant in comparatively small colonies and were most frequently associated with white spruce, hardwood and riparian ecosystems. Foraging substrate consists of decayed deciduous leaves and herbaceous plants. Down woody material is an important habitat element. Additionally, striate disc were found only in relatively undisturbed forested sites, with minor sun exposure and minor grazing and logging pressure, and most sites were protected by topography, down logs, or other physical features. Sites where the striate disc occurs appear restricted to the higher elevations of the limestone plateau of the west-central and north-central portions of the Black Hills. The striate disc was found to co-occur with Cooper's mountain snail, but more commonly with the mystery vertigo, callused vertigo, and cross vertigo (USDA-Forest Service 2005a). Striate Disc has been observed in the Project Area (USDA-Forest Service 2007c).

Environmental Consequences - Callused Vertigo Snail, Frigid Ambersnail, Mystery Vertigo Snail, and Striate Disc Snail

Alternative A

These snail species depend on undisturbed, shady habitat with organic surface litter. The striate disc, mystery vertigo, and callused vertigo are found in shady areas in white spruce, hardwood and riparian areas. The frigid ambersnail is found in somewhat more open ponderosa pine habitats, but also requires organic cover and shaded conditions. Long-term habitat changes under this alternative include an increase in canopy cover, shade and organic material, providing additional snail habitat. Due to the currently restricted distribution of the species on the Forest and limited dispersal capability, however, changes in habitat are not expected to substantially increase species distribution on the Forest.

Alternative B (Proposed Action) - Direct and Indirect Effects

Potential direct effects to callused vertigo, frigid ambersnail, mystery vertigo and striate disc snail include individual mortality due to timber harvest, road building and prescribed burns on unknown snail colonies. Indirect effects also include habitat alteration due to timber harvest. Because snail habitat thresholds are not known, specific impacts of changes to habitat moisture and light are not known, therefore it is only possible to discuss theoretical effects. The potential direct and indirect effects due to Alternative B on these snail species are the same as discussed for Cooper's Mountain Snail. The reader is referred to that discussion.

Alternative B (Proposed Action) - Cumulative Effects

The direct and indirect effects of Alternative B combined with the past, present and reasonably foreseeable future actions would result in a decrease in shaded forest habitat and organic ground litter in the Project Area, potentially leading to a decrease in populations of SOLC snail species in the Project Area.

Privately owned lands within the Forest boundary may also provide suitable habitat, however, the extent and persistence of such habitat is uncertain. Continued urban development in the Black Hills would likely continue to affect habitat, including riparian areas, thereby increasing the importance of habitat on NFS land.

Alternative C - Direct and Indirect Effects

In addition to treatments proposed by Alternative B, Alternative C proposes an additional 686 acres of fuels treatments in Spearfish Canyon. According to Frest Survey data, there are 13.2 acres of suitable snail habitat within the Alternative C additional treatment area. Survey data is, however, limited and it is common knowledge that snail colonies exist throughout a large portion of the Canyon (Frest and Johannes 2002). It is therefore likely that additional habitat exists and may be impacted by activities in this alternative. The potential direct and indirect effects of Alternative C to these snail species are the same as discussed for Cooper's Mountain Snail. The reader is referred to that discussion.

Alternative C - Cumulative Effects

Cumulative impacts would be the same as discussed under Alternative B with the added impact of additional treatments under Alternative C.

3.6 Botany

3.6.1 Existing Conditions for Botany

Plant Surveys

Site specific survey information was used to assess the current conditions of the botanical resources within the Project Area as well as analyze the potential impacts of the proposed actions. The West Rim Project Area was surveyed for botanical values as part of past projects from 1994 through 2004 and specifically for the West Rim project in 2005. Additional surveys were conducted in 2006 as part of Forest Plan monitoring.

The 2005 botanical surveys targeted Region 2 Sensitive Species, Species of Local Concern (SOLC), species with insufficient information, other South Dakota and Wyoming tracked species, and other species of interest (Mergen 2005). In addition to locating and recording individual target plant species, the survey was used to identify and map community types and determine the probability of an area to support target plant species. The district botanist further interpreted the data to determine locations of suitable plant habitat within the Project Area. The community types identified as target plant habitat were then mapped and entered into a geographical database (Zacharkevics 2007c).

The 2005 plant survey, in addition to a 2003 survey, covered most of the 43,000 acres of National Forest System lands within the Project Area; however there is an area that is slightly more than 5,000 acres in size that was added to the project after these surveys were conducted. This area was not included in the 2005 botanical survey and ground verified data on suitable plant habitat and species occurrences is not available for this area at this time. Potential plant habitat in this area would be surveyed prior to implementation of any proposed actions within the area. It has been observed in the Northern Black Hills that moisture is one factor driving the presence of high probability target plant habitat for most target plant species (Zacharkevics 2007c).

Plants of Interest within the Project Area

Plants Known to Occur in the Project Area

Suitable habitats for plant species of interest in the area include moist forested communities and riparian communities. The Project Area contains a high concentration of rare and unique plant species and suitable habitat when compared to other areas on the Northern Hills District and the rest of the Black Hills (Zacharkevics 2007c). The Black Hills contains four confirmed Sensitive Plant species, and three Species of Local Concern (SOLC). SOLC are plant, fish and wildlife species (including subspecies or varieties) that do not meet the criteria for sensitive status. These can include species with declining trends in only a portion of Region 2, or those that are important components of diversity in a local area. The three plant species that are on the plant SOLC list that are known to occur in the Project Area include; stiff clubmoss, northern hollyfern, and shining willow. Appendix B of the Botany Resource Report (JW Associates 2008e) provides a list of the SOLC plant species for the Forest and the rationale for those that are included in the analysis of the West Rim project.

In addition, there are five identified plant species in the Project Area that are not included on either the sensitive plant list or the SOLC plant species list. These species are not assessed in detail but are mentioned because they are of interest when assessing the diversity of plant species in the area. These species of interest are found in similar habitats as many of the SOLC. Management actions designed to protect habitats for SOLC would benefit many of these other species of interest. The Sensitive Plant Species, SOLC, and unique species known to occur in the Project Area are listed in Table 32.

Table 32. Plants of Interest Known to Occur in the West Rim Project Area

Scientific Name	Common Name	Designation
Botrychium lunaria	common moonwort	Other unique species
Botrychium minganense	Mingan moonwort	Other unique species
Carex alopecoidea	foxtail sedge	R2 Sensitive
Corallorhiza trifida	yellow coralroot	Other unique species
Cypripedium parviflorum	yellow lady's slipper	R2 Sensitive
Hierochloe odorata	sweetgrass	Other unique species
Lycopodium annotinum	stiff clubmoss	SOLC
Orobanche uniflora	one-flowered broomrape	Other unique species
Platanthera orbiculata	large round-leaved orchid	R2 Sensitive
Polystichum lonchitis	northern hollyfern	SOLC
Salix lucida ssp. *caudata*	shining willow	SOLC
Viburnum opulus var. *americanum*	American cranberrybush	R2 Sensitive

Suitable Habitat in the Project Area for Sensitive Species

The West Rim Project Area contains a high percentage of suitable habitats for many of the SOLC and Sensitive Plant Species (Figure 9). The 2005 botanical surveys identified 6,493 acres of verified target plant habitat in the Project Area, or 15 percent of the National Forest System lands within the Project Area. The habitats include moist spruce dominated by spruce or birch (mostly in the southern half of the Project Area). Co-dominants and understories of other hardwoods such as hazelnut, ironwood, and aspen are present on some of these sites. Other habitats identified include birch/mixed hardwood stands (mostly in the northern half of the project), and riparian areas along drainages including Spearfish Creek, Iron Creek, and Pettigrew Gulch. A few target habitats have a portion (less than 30 percent canopy cover) of overstory pine. Other moist sites, boggy areas, and areas with willow or sedges are also target plant species habitat within the Project Area.

There is a data gap in the Project Area that includes a large portion of Spearfish Creek and its water influence zone. This area is currently under contract to be surveyed. Therefore, there may be additional Sensitive Plant Species and SOLC occurrences and habitat within the Spearfish Canyon. For the analysis of effects it is assumed that the unsurveyed area within Spearfish Canyon is suitable habitat.

Individual Sensitive Plant Species Known to Occur in the Project Area - Habitat and Occurrence

Foxtail sedge (Carex alopecoidea)

Foxtail sedge is a perennial graminoid with stout culms 16 to 31 inches tall. Habitat conditions associated with this species include seasonally saturated meadows, openings in alluvial woods and stream banks, usually over calcareous substrates.

There is one known occurrence of foxtail sedge within the Project Area, located in 2002 in a riparian meadow. The site is an open graminoid-dominated drainage with patches of hazel, willow, and hawthorn. The occurrence occupies an area greater than two acres and runs along a small stream. Grazing of livestock in the area has impacted the site in the past (USDA-Forest Service 2007c). No new occurrences were discovered during the 2005 surveys.

The Black Hills National Forest is on the western edge of this species' range. Approximately 31 occurrences have been documented between 2001 and 2003 (USDA-Forest Service 2007a). The majority of currently known sites occur along the upper headwaters of low gradient perennial streams. The majority of the sites are associated with old beaver dams and ponds where flooding and past disturbance have created wet to moist meadow habitat. Black Hills foxtail sedge sites are most often open, with little or no canopy cover and are located at elevations between 4,100 and 6,400 feet. Foxtail sedge individuals appear to occur primarily in the transitional areas between saturated soils and the adjacent mesic upland areas (USDA-Forest Service 2005a).

Potential threats to the persistence of this species on the Black Hills include the loss of occurrences and suitable habitat due to alteration of the hydrologic characteristics of riparian habitats (Moore et al. 2006). The impacts from grazing, presence of invasive species and the proximity to private property and the associated human activities are also a concern.

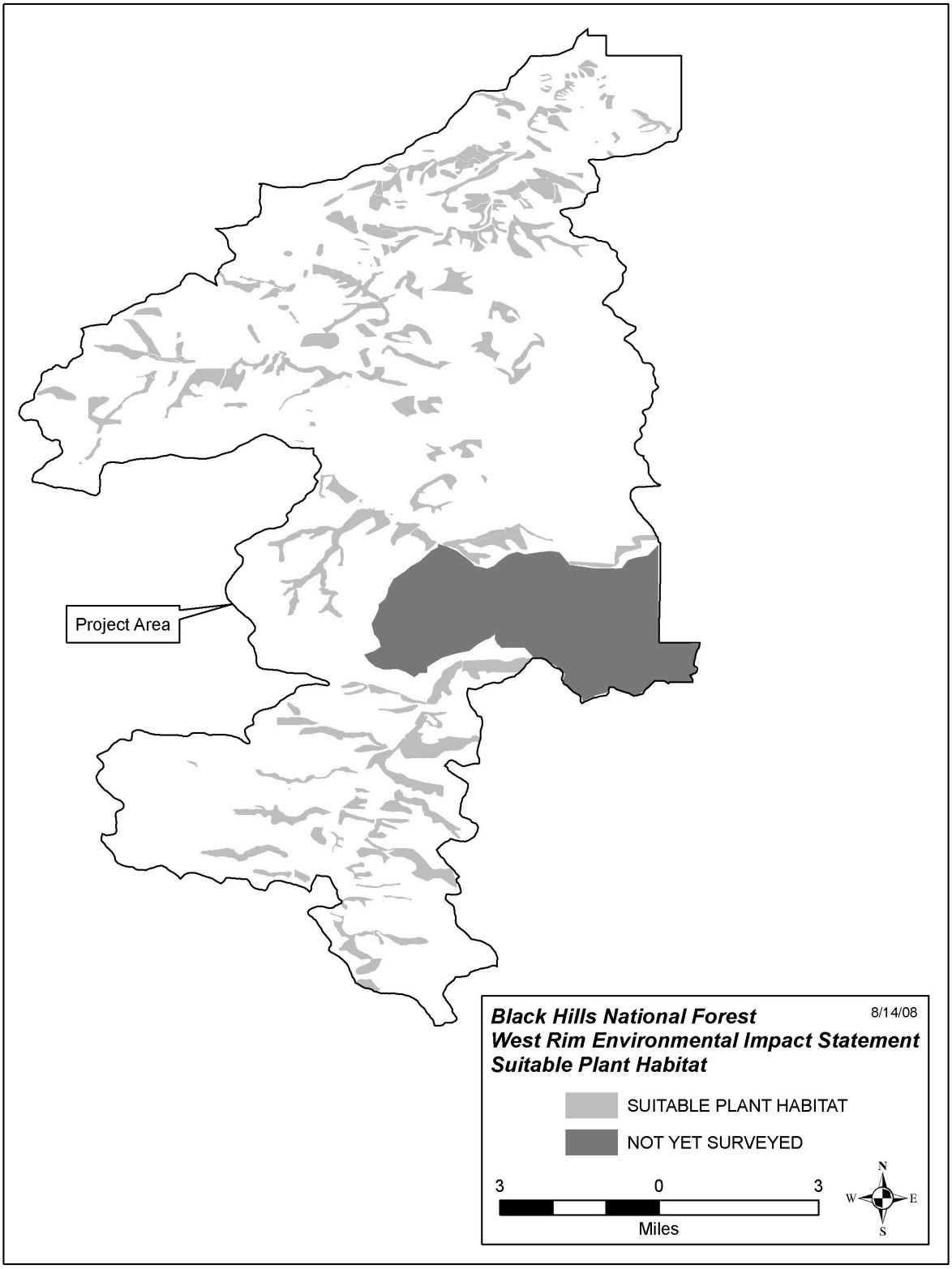

Figure 9. Known Suitable Habitat for SOLC and Sensitive Plant Species[1]

[1] Habitat surveys in the not yet surveyed category have been contracted but not completed.

Yellow lady's slipper (Cypripedium parviflorum)

Yellow lady's slipper is an herbaceous perennial with stems averaging from 10 to 12 inches in height. Plants may occur singly, or in groups of several to over 300 stems. The showy yellow flowers are produced in the Black Hills from late May through July and into early August. Like many orchids, this species is assumed to be dependent on fungi in the soil for survival.

Across its geographic range, Yellow lady's slipper is generally found in shady deciduous and mixed woodlands near streams, shrublands, swamps, bogs, and wet forests (Mergen 2006). 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 (USDA-Forest Service 2005a).

There are approximately 849 individual plants of this species known to be in the Project Area. One location has more than 100 individual plants. These occurrences are found primarily scattered throughout Spearfish Canyon but a few individuals are located outside of the canyon. The plants found in the Project Area account for about 21 percent of the known plants of this species on the Black Hills National Forest. In the Project Area, Yellow lady's slipper are found in a variety of habitats. However, most were found in shade or partial shade on soils ranging from saturated to dry mesic (USDA-Forest Service 2007c).

There are approximately 3,986 individual plants of Yellow lady's slipper currently known to exist on the Black Hills National Forest. These plants are found as individual plants, in small groups of 2 to 10 plants, as well as in larger groups numbering more than 100 plants. The species is widely dispersed geographically across the northern and central Black Hills. Because this species is widely distributed on the Black Hills National Forest, it is less likely to become extinct due to a single stochastic event (Mergen 2006).

Large round-leaf orchid (Platanthera orbiculata)

Large round-leaf orchid is a herbaceous perennial characterized by two rounded, opposite, shiny leaves three to four inches wide that lie flat along the ground and a single flowering stem 12 to 24 inches high that bears 5 to 20 whitish-green flowers. Flowering in the Black Hills occurs from late June to August; the flowers produce a light fragrance at night, attracting moth pollinators (*Lepidoptera*) (USDA-Forest Service 2005a).

This species has 20 documented occurrences in the West Rim Project Area. Documented sites range from 4,350 to 6,150 feet in elevation. Most occurrences have been found in partial shade on dry mesic to moist soil conditions. Associated overstory species include paper birch, white spruce and, on few sites, ponderosa pine. Occurrences range from a single plant to up to 70 individual plants. The area covered per occurrence ranges from less than one square foot up to 25 acres (USDA-Forest Service 2007c).

Large round-leaf orchid is relatively secure in the Black Hills based on the large number of occurrences (greater than 30) that are distributed in three geographically separated regions on the Forest (USDA-Forest Service 2007a). In the Black Hills, scattered occurrences are located on 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 Large round-leaf orchid occurs (Hornbeck et al 2003c).

Highbush cranberry (viburnum opulus var. americanum)

Highbush cranberry is a deciduous shrub that grows to 13 feet tall, with smooth, light gray to brownish branches. It has numerous white flowers in terminal, flat-topped clusters. The fruits develop from August to September and are bright orange to red in color. On Forest lands, highbush cranberry is primarily associated with moist but well-drained sites and grows in dense shrub thickets and in deciduous woodlands with a variety of canopy covers. Sometimes the shrubs are found along streams with running water. 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 2005a).

There are four documented occurrences of highbush cranberry in the Project Area. These sites range in elevation from 4,960 to 5,687 feet. The species was found in the open and in partial shade on dry mesic to saturated soils. Associated tree species included paper birch, trembling aspen, and white spruce (USDA-Forest Service 2007c).

Surveys (2002-2005) have found more than 30 occurrences of highbush cranberry on the Black Hills National Forest. Known locations are geographically dispersed and are located in at least ten sixth level watersheds in the Northern Hills in South Dakota and Wyoming (USDA-Forest Service 2007a).

This shrub species is often intermingled with a number of other shrub species in dense, nearly impenetrable thickets. Unless the species is specifically targeted during surveys, there are times when it may not be noticed in dense thickets. It is likely that the numbers of reported occurrences is a conservative number (USDA-Forest Service 2007a).

Individual Sensitive Plant Species with Possible Suitable Habitat but No Known Occurrences

Trailing clubmoss (Lycopodium complanatum)

Trailing clubmoss is common across northern latitudes but sparse at the southern limits of the species' distribution, such as in the Black Hills. In the Black Hills, trailing clubmoss is disjunct from the nearest occurrences in the Rocky Mountains and is restricted to remnant, boreal white spruce habitats on steep, north-facing slopes and streamside benches (USDA-Forest Service 2005a). There are nine occurrences of trailing clubmoss on the Black Hills Forest. These populations are located on shaded, north-facing slopes in white spruce/paper birch forest, and in moist side drainages.

The persistence of this species in the Black Hills is at risk due to the small number and size of their populations, which makes them vulnerable to random stochastic events and invasion by invasive plants (Hornbeck et al 2003a). There are few apparent or ongoing risks to the species at the known locations, but those locations of this boreal remnant species are small enough that random events, such as drought or fire, could eradicate them (USDA-Forest Service 2007a).

Bloodroot (Sanguinaria canadensis)

Bloodroot is a perennial herb that produces a single kidney-shaped basal leaf and a single white flower, and is one of the earliest spring flowers to appear in the Black Hills. Bloodroot occupies floodplains, forested terraces, drainage bottoms, and north-facing footslopes in open, rich, hardwood plant communities. The currently known range in the Black Hills is limited to the northeast portion of the Black Hills, from the east side of Spearfish Canyon to west of Tilford. Currently known elevation range is 3,940-5,000 feet.

Bloodroot is one of the most abundant Sensitive Plant Species on the Black Hills National Forest (USDA-Forest Service 2007a). There were 22 known occurrences of bloodroot on Forest lands at the time of a species assessment (Hornbeck et al. 2003a). The species is considered secure on the Forest at this time.

Prairie moonwort (Botrychium campestre) and Narrowleaf Grapefern (Botrychium lineare)

Region 2 sensitive plant species that occur on the Black Hills National Forest but for which there is limited information on the habitat requirements include two species of *Botrychiums*. These species include prairie moonwort and narrowleaf grapefern.

In the Black Hills, there are five confirmed sites of prairie moonwort on National Forest lands. Range wide, prairie moonwort is considered an uncommon species with a very patchy widespread distribution. It is a grassland species associated with sandy grassland habitats in prairies, dunes, railroad sidings, and fields over limestone (USDA-Forest Service 2005a). It reaches the southern edge of its range in Region 2 and is known from only a few scattered sites within the region (USDA-Forest Service 2005a).

Narrowleaf grapefern has been located in four occurrences on the Black Hills National Forest. This species may be a habitat generalist since habitat across its range is quite variable and its range stretches from sea level in Quebec to approximately 10,000 ft. in Colorado. Narrowleaf grapefern has been observed growing in primarily open habitats, often in areas with documented disturbances, both human-caused and natural, and in limestone-based sites (USDA-Forest Service 2005a).

Individual SOLC Species Found to Occur in the Project Area - Habitat and Occurrence

Stiff clubmoss (Lycopodium annotinum)

Stiff clubmoss is an evergreen, perennial herb with branched upright stems and needle-like leaves. The species reproduces sexually through spores and vegetatively through creeping rhizomes that allow rapid clonal expansion. It is widely distributed in boreal habitats of North America. Stiff clubmoss also occurs in swampy or moist coniferous forests, mountain forests, and exposed grassy or rocky sites (USDA-Forest Service 2005a).

Only one occurrence of this species is known within the Project Area. Stiff clubmoss was found in 2005 in the Timber Gulch drainage. It was found on a north aspect on a 31 to 40 percent slope, in moist soils, under partial shade of a spruce/hazelnut/pine plant community. The site was characterized as a small north-facing drainage with much forb cover, grouseberry, and blowdown. Grazing was present in the area (Mergen 2005).

There are four reported occurrences of this species on the Black Hills. All are associated with high moisture microclimates between 5,100 and 6,500 feet in elevation. They are found in boreal white spruce and paper birch/beaked hazelnut communities (USDA-Forest Service 2007a).

The persistence of Stiff clubmoss in the Black Hills is at risk due to both the small number and size of occurrences, which makes the species vulnerable to random events (such as high intensity fire), invasive plant species, and weed treatment (Hornbeck et al 2003). Some sites are at risk from livestock impacts. It may be that this species is more sensitive to small shifts in microhabitat conditions in the Black Hills than in other parts of its range. The surrounding habitat structure may exert a strong influence on suitable habitat conditions particularly with regards to shade and the amount of available moisture (Hornbeck et al 2003).

Northern Hollyfern (Polystichum lonchitis)

Northern hollyfern is a forest fern that is commonly associated with white spruce, paper birch and beaked hazel. Twenty records of this species have been reported for the Black Hills National Forest (Zacharkevics 2007a). It is associated with moist, shaded, north-facing slopes in forested ravines and gulches on limestone substrates. Northern hollyfern in the Black Hills is limited by the small extent of cool, moist boreal habitat. As with other boreal remnant species, long-term drought or dramatic climate changes characterized by drier and warmer conditions may present the greatest risk to northern hollyfern and its habitat. Other risks are associated with the potential for Off Road Vehicle impacts, livestock trampling, water developments, and activities associated with road construction. Noxious weeds and invasive species are a risk to occurrences and wildfire and suppression activities can also be considered a risk. Collectors may desire the species and depending on the level of interest collection could present a risk. No impacts from any of these risk factors were observed at occurrences in 2006 (USDA-Forest Service 2007a).

Northern hollyfern was found in one location in the Project Area during the 2005 survey. It was located on a north aspect with a slope greater than 55 percent and plants were in moist soils in a spruce/hazelnut/birch plant community. Tree canopy of birch and spruce was estimated at 75 percent. Shrub cover was very great (90 percent) and most of it was hazelnut, but birch was also present in this canopy layer. Moss cover was estimated to be 60 percent and litter 85 percent. This occurrence was found in the watershed with the greatest reported plant family diversity (Mergen 2005).

This fern is currently assigned a rank of critically imperiled (S1) in South Dakota. The global rank for northern hollyfern is demonstrably secure (G5) (NatureServe 2007).

Shining Willow (Salix lucida ssp. caudata)

Shining willow is a shrub or small tree up to 4 meters in height. The catkins of shining willow emerge in May and produce seed in June. This species is reported to produce low amounts of seed, have a slow seed spread rate, have low seedling vigor, and to have a slow vegetative spread rate (USDA-Forest Service 2005a).

Shining willow was located within Spearfish Canyon during a 2006 plant survey. This occurrence was found on the bank of Spearfish Creek with other willow species. Two plants of this species were identified in this location. Spruce was the major overstory tree species off the creek on one side; the other side of the creek

bank was in the road influence zone and there was no native plant community present (USDA-Forest Service 2007c). This species is commonly associated with stream banks, shores, wet meadows, and seeps.

Two confirmed locations of this subspecies (spp. caudata) have been reported for the Black Hills National Forest. This species was historically documented (1913) from the Black Hills but has never been relocated. Shining willow was thought not to exist in the Black Hills until a new location for shining willow was found in 2006 in Spearfish Canyon (within the Project Area). Due to the small number of individuals known, it is uncertain if there is a breeding population with potential for seed production. There is, however, a good deal of suitable habitat yet to be searched, particularly in Spearfish Canyon (USDA-Forest Service 2007a).

Shining willow is considered to be globally secure as indicated by the assigned rank (G5). Currently it is ranked critically imperiled (S1) in South Dakota.

Willow species are preferred forage by livestock and wildlife. However, the occurrence of shining willow along Spearfish Creek in Spearfish Canyon is not in an active allotment so it is not at risk from livestock grazing. Spearfish Creek is very close to Highway 14A in Spearfish Canyon and while the shining willow plants are on the opposite side of the creek from the highway, there are still risks from the road. Those risks include runoff of road chemicals to the stream, introduction of noxious weeds and invasive species, and impacts from noxious weed treatment. Based on the distribution now known, shining willow is vulnerable to catastrophic and stochastic events. The primary risk to this facultative wetland species' persistence and reproductive success is any lowering of the water table where it occurs, whether natural or human induced. No impacts from these risks were observed in 2006 (USDA-Forest Service 2007a).

SOLC Plants with Suitable Habitat but no Occurences in the Project Area - Habitat and Occurrence

Four SOLC plant species have suitable habitat within the West Rim Project Area but are not known to occur in the area. These plant species are; leathery grapefern, pleated gentian, broadlipped twayblade, and narrowleaf sweet coltsfoot).

Leathery grapefern (Botrychium multifidum)

Leathery grapefern is an evergreen species that reproduces by wind dispersed spores (USDA-Forest Service 2005a). *Botrychiums* are dependent on mycorrhizal fungi for water and nutrient uptake. This relationship allows moonworts and grapeferns to remain dormant for several years. The condition of mycorrhizal species on a site is dependent on an adequate supply of soil moisture (USDA-Forest Service 2005a).

Currently on the Black Hills National Forest, the majority of known locations are in mesic sites next to riparian areas dominated by spruce or mixed spruce-pine along small, perennial streams. Currently most known populations are located only a few meters from stream channels along Iron Creek, Nelson Creek, and Lost Cabin Creek; all within the Norbeck Wildlife Preserve or the Black Elk Wilderness. One exception is a single site in the Bear Lodge Mountains in a steep narrow drainage within a birch/hazelnut community on sandstone. Plants are found on moss-covered sandstone boulders and streambanks near occasional pools of water. In general, plants in the Black Hills are associated with mossy mats. Individuals of leathery grapefern have been found in duff under spruce, in grassy margins along streams, on sand/gravel bars along streams, and

in mesic soils near hiking trails. Known locations of this plant in the Black Hills range from 4,620 to 6,400 feet in elevation.

Pleated Gentian (Gentiana affinis)

Pleated gentian is a perennial forb with fleshy fibrous roots, is 4 to 16 inches tall, and has clustered and stalkless purple flowers at the top of its stems. It flowers from August through September and produces seeds in capsules from September through October (Larson and Johnson 1999). Pleated gentian is not known to occur within the Project Area but potential habitat exists. This was a target species in the 2005 botanical surveys of the Project Area.

Less than 10 pleated gentian occurrences have been reported on the Black Hills National Forest, primarily in limestone areas at elevations from approximately 5,000 to 6,500 feet. This species is considered a facultative upland species in South Dakota, meaning that it can occur in wetland habitats but typically occurs in upland areas. In the Black Hills, this gentian is reported to occur in moist areas in open conditions, sometimes near wet meadows, fens, and stream margins in limestone areas. (USDA-Forest Service 2007a)

Throughout its range, Pleated gentian is considered to be globally secure (G5). In South Dakota the assigned rank is imperiled (S2) (NatureServe 2007).

The primary risks for Pleated gentian are related to intensive grazing or trampling by livestock since the species is sensitive to disturbance, including trampling by animals. Thus, pleated gentian is expected to decline with heavy grazing (Larson and Johnson 1999). The large occurrences documented in 2006 were located in exclosures from livestock grazing. Conifer encroachment may present a risk to this species. Other risks include invasive species, drought, and wildfire and suppression activities (USDA-Forest Service 2007a).

Broadlipped Twayblade (Listera convallarioides)

Broadlipped twayblade is not known to occur within the Project Area. This species was a target species for the 2005 botanical surveys. Broadlipped twayblade was first discovered in 1970 in the Black Hills; a second site was located in 1994. Both sites are located within Lawrence County. The elevations range from 5,800 to 6,200 feet at this site. The broadlipped twayblade plants are located in saturated soil conditions adjacent to wet springs, and under tree canopies composed mostly of white spruce (USDA-Forest Service 2007a).

Throughout its range, broadlipped twayblade flowers from June through September, typically occurs on rich humus in open woods and boggy meadows, and prefers cool soil. In South Dakota and eastern Wyoming, this species is considered a facultative-wetland species and has a high tolerance to anaerobic conditions. Broadlipped twayblade is also considered to be highly tolerant to fire and shade. As with many orchid species, broadlipped twayblade has a slow seed spread rate, low seedling vigor, and a slow vegetative spread rate (USDA-Forest Service 2005a).

The assigned global conservation rank for this northern species is demonstrably secure (G5) (NatureServe 2007), although it may be rare at the edges of its range where microhabitat requirements are met less often. The southern occurrences of northern species are often more disjunct and smaller than northern occurrences, often limited by the availability of cooler and moister conditions. This may be the case with the occurrences of broadlipped twayblade in the Black Hills. Broadlipped twayblade is currently assigned a conservation rank of

critically imperiled due to rarity (S1) in both South Dakota and Wyoming (NatureServe 2007). This rank is assigned to several boreal species in the Black Hills that are similarly limited to a low number of disjunct occurrences at the southern end of their ranges (USDA-Forest Service 2005a).

Risks to broadlipped twayblade include invasive plant species, grazing or trampling by livestock or wildlife, collection, loss of riparian habitat, or alteration of hydrologic function in the species habitat. The greatest risk to the species in the Black Hills may be that it is currently limited to two known occurrences. Therefore, high intensity disturbance events such as a crown fire during drought or sediment covering the sites could result in the loss of both occurrences. Another risk identified for northern boreal plant species including broadlipped twayblade is a climatic trend towards warming and drying conditions. The species may not be able to persist in the Black Hills under this type of climatic trend (USDA-Forest Service 2007a).

Narrowleaf Sweet Coltsfoot (Petasites sagittatus)

Narrowleaf sweet coltsfoot is a rhizomatous forb of boreal forests that typically flowers before the leaves expand in the spring. Seed or pollen transport may occur via water, wind, migratory birds, or insects. Because the Black Hills occurrences are over 100 miles from occurrences elsewhere within its range, natural pollen and seed transfer between occurrences is likely limited (USDA-Forest Service 2005a).

Narrowleaf sweet coltsfoot is not known to occur in the Project Area but suitable habitat exists in the area. There are 15 reports of this species listed in the Black Hills National Forest plant database. The reports are distributed in six watersheds (sixth order) located in the central Black Hills, under a variety of associated conditions. Sites are characterized by open to partial tree canopies and range in elevation from 5,400 to 6,750 feet. Individuals are associated with dry to mesic to wet meadows and gentle slope areas along streams with saturated soils. White spruce is the tree species documented at several sites; however, aspen and ponderosa pine are also documented. A variety of willow species are documented at a majority of reported locations (USDA-Forest Service 2007a).

Currently the assigned global conservation rank for this northern species is demonstrably secure (G5). The southern occurrences of northern or boreal species are often more disjunct and smaller than northern occurrences, limited by the availability of cooler and moister conditions. This is likely the case with narrowleaf sweet coltsfoot occurrences in South Dakota. Narrowleaf sweet coltsfoot is currently assigned a South Dakota conservation rank of critically imperiled (S1) because of rarity (NatureServe 2007), however, since that rank was assigned, recent newly discovered site reports (2004) have increased the total number above those identified in the S1 definition, and it may be expected that the state rank will likely be revised to a higher rank in the future to reflect this new information (USDA-Forest Service 2005a).

Since narrowleaf sweet coltsfoot is a facultative wetland species, the primary risk to its persistence and reproductive success is any lowering of the water table or altered hydrology where it occurs, whether natural or human-induced. Noxious weeds and other invasive species, effects associated with intensive livestock use, recreational impacts and climatic change (drought stress) are also risks (USDA-Forest Service 2007a).

3.6.2 Environmental Consequences for Botany

This section analyzes the potential effects of the proposed actions on Sensitive Plant Species and SOLC plant species that are known to occur in the Project Area as well as those not known to occur, but which may have suitable habitat within the area. All of these plant species are associated with the more moist environments in the Project Area. Suitable habitats for these plant species include moist spruce stands, birch/mixed hardwood, and riparian areas along drainages.

Effects Common to All Alternatives

Some of the risks to individual Sensitive Plants and SOLC as well as potential habitats are present under all the alternatives. These include risks associated with on-going uses of the area as well as larger climatic changes.

Livestock grazing is permitted in portions of the Project Area. This proposal would not change how livestock is managed. Any existing risks of damage to Sensitive Plant Species or SOLC from grazing or trampling by livestock would be the same for all the alternatives.

None of the alternatives would substantially change the recreational use of the Project Area. Risks from recreational use of the area would be the same for all alternatives. These include risks of damage to individual plants as well as degradation of suitable habitat from off road vehicle use, trampling, and collection.

On-going development in the area would create the same potential effects to individual plants and their habitats for all alternatives. These effects include possible degradation and loss of habitat from road building and land clearing on privately owned lands. These activities could affect habitats through increased sediment delivery to streams and alterations of hydrologic function in adjacent suitable habitats. Potential effects associated with the existing road system, including the highway that runs along Spearfish Creek, would be the same for all of the alternatives. The impacts from these roads include possible runoff of road chemicals and sediment to streams and loss of suitable moist forested and riparian habitat.

Climate change is another potential threat to the long-term persistence of many of the rare plants found on the Black Hills National Forest. The climatic trend is towards warmer and drier conditions. All the SOLC and Sensitive Plant Species in the area (including those that are not documented but whose habitat is present) are associated with moist, relatively cool environments. Long-term drought or dramatic climate changes characterized by drier and warmer conditions may result in the loss of suitable conditions for many of these species.

Alternative A (No Action) - Direct and Indirect Effects

There would be no direct effects to known occurrences of SOLC or Sensitive Plant Species since no new actions are proposed. On-going activities such as recreation, fire suppression, livestock grazing, and road maintenance would continue. Management activities analyzed under other environmental documents would continue. Alternative A would maintain existing habitat and protect known occurrences of SOLC and Sensitive Plant Species in the short-term (next 5 to 10 years). There could be long-term, indirect effects to suitable habitat. Effects could include changes in species composition due to succession, the introduction of an invasive species, or natural disturbances such as wildfires, floods, and insects or disease.

Alternative A (No Action) - Cumulative Effects

The cumulative effects analysis assesses the potential cumulative effects of the past, present and future foreseeable actions on SOLC and Sensitive Plant Species and their habitat in the Project Area. The time period used for the analysis is 10 to 15 years. This temporal scale is used since future foreseeable actions beyond this time frame are not known and predicting effects beyond this time period become less certain.

The past and present land uses of the Project Area have had an effect on the number of rare plants found in the area as well as the amount of suitable habitat present. Soil disturbance, introduction of invasive species, and changes in moisture and hydrologic regimes can negatively affect SOLC and Sensitive Plant Species and their suitable habitats. Historical use of the Black Hills has decreased the suitability of moist forested and riparian areas. The human uses responsible for these decreases include livestock grazing, road building, fire suppression, recreational use, mining activities, water diversions, and near-extirpation of beaver. These activities have decreased the suitability of many of the habitats for rare plant species.

Fire suppression efforts over the last 100 years in the Black Hills have increased the likelihood of intense wildfires in some areas. Drier habitats would have burned more frequently prior to widespread fire suppression. Fire suppression increases fuel loads on many sites, creating conditions that are conducive to hotter, more intense burns. Prior to aggressive fire suppression, it is likely that the more moist habitats on the Black Hills did not burn frequently; with the more frequent low intensity fires on adjacent drier sites. These low intensity fires would not have had the intensity to burn through these wetter environments. However, under extreme conditions such as prolonged drought or high fuel loads due to insect infestations or wind storms, more intense fires could burn some of these moist habitats. Continued fire suppression, in the absence of other vegetation treatments, is likely to increase fuel loading, and increase the risk of intense fires that could burn suitable habitat and potentially existing populations.

Silvicultural treatments that lower the potential for crown fires would benefit suitable plant habitat. Management that includes prescribed burning and harvesting of adjacent conifer stands can help maintain a mosaic of seral stages, increase available moisture, and decrease the potential for widespread crown fires.

There are several future foreseeable actions that may indirectly affect the wildfire potential of the Project Area. The Griggs fuel management project is adjacent to the West Rim Project Area. This project includes thinning 1,170 acres, prescribed burning 500 acres and the creation of fuel breaks on 326 acres. The Citadel Project Area is also just to the west of the West Rim Project Area. Implementation of this project will begin in the next year. The Citadel project includes vegetative and fuels treatments on a total of 17,780 acres to reduce the density of pine stands and fuel loads. Another future foreseeable action includes the Telegraph project just to the south of the West Rim Project Area. This project would address an increase in mountain pine beetle activity and could involve silvicultural treatments to reduce the wildfire potential of the area. These on-going and possible future treatments in adjacent areas would reduce the risk of crown fire spread into the West Rim Project Area.

Alternative A would not directly reduce fuel loadings in the Project Area. Suitable habitats would still be at risk from high intensity fires that develop within the Project Area.

Noxious weeds exist in the Project Area along roads and other areas of soil disturbance related to past management activities. There are approximately 213 miles of road on NFS land in the Project Area. Most of these roads have been present for several decades. There are also 200 miles of road on private land. These roads provide corridors for the dispersal of invasive weeds and provide access for ATVs and other soil disturbing activities. Alternative A would not change travel management. No new roads or road reconstruction would take place. Therefore, there would be no cumulative effects from new or reconstructed roads. The Forest is currently revising its Travel Management Plan. The new forest-wide plan will designate which routes can be used and for what activities. This plan may reduce the miles of open road within the Project Area.

Alternative B (Proposed Action) - Direct and Indirect Effects

Forest Plan standards and guidelines, as well as specific project design criteria, would reduce the potential for negative impacts to SOLC and Sensitive Plant Species and their habitats in the Project Area. Plant surveys would be completed in areas that were not surveyed prior to implementation and any new occurrence of SOLC or Sensitive Plant Species and/or suitable habitat would be avoided. All known occurrences of these species as well as suitable habitat would be excluded from timber harvest areas and avoided during harvesting operations, including any new habitat or plants identified prior to or during implementation of the proposed actions. Any suitable plant habitat included within the proposed burn units would not be directly ignited and construction of control lines would avoid suitable habitat. A botanist would work with the road engineer and pre-sale personnel to determine the best placement of any proposed new road construction, skid trails, temporary roads, or landings that could potentially cross habitat suitable for SOLC and Sensitive Plant Species. There would be non-mechanical treatment of natural fuels in some habitat suitable for rare plants. A no treatment buffer would be placed around known and/or newly discovered occurrences of SOLC and Sensitive Plant Species in these treatment areas.

Effects of Timber Harvest

Mechanical vegetation treatments have the potential to directly affect SOLC and Sensitive Plant Species 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. Design criteria for this alternative disallow mechanical treatment in suitable habitat. Therefore direct effects are likely to be minimal. However, the possibility still exists for overlap between suitable habitat and adjacent mechanical treatment units, due to differences in accuracy in mapping and human error (Zacharkevics 2007b). These are the areas where adjustments would be made when the treatment units are identified on the ground, prior to implementation of the vegetation treatments. These stand boundaries would be adjusted so that all the SOLC and Sensitive Plant Species and their suitable habitats would be excluded from any area of commercial timber harvest.

The timber harvest treatments are not likely to have any direct effect to these known occurrences. The location of the possible sanitation harvests area not known but would be subject to the same rare plant design criteria and would not occur within suitable habitat or near known locations of plant SOLC and Sensitive Plant Species.

A potential indirect effect of timber harvest is an increase in the spread of invasive plant species in areas adjacent to habitats suitable for SOLC and Sensitive Plant Species. Ground disturbance caused by logging equipment in harvest areas can create conditions suitable for the establishment of invasive plants. The establishment of these weeds in areas adjacent to suitable habitat could increase the likelihood of spread to habitats suitable for SOLC plant species. The establishment of invasive plant species could reduce the quality of these areas for rare plants. Design criteria include minimizing ground disturbance and re-vegetating areas that are disturbed, as well as measures to reduce the spread of noxious weeds. These measures would reduce the chances of invasive plant species becoming established within suitable rare plant habitats as a result of proposed harvesting activities.

Effects of Prescribed Burning

Prescribed fire is proposed for use both in harvest areas and outside of commercial harvest. The purpose of prescribed burning is to reduce the wildland fuels to reduce the risks of a hot burning wildfire. These proposed prescribed burn blocks are bordered by existing roads. These roads, rather than constructed fire lines, would be used to contain the prescribed fires.

There are 200 acres of field verified suitable plant habitat that occur within proposed prescribed burn blocks under Alternatives B and C. There are an additional 590 acres of land that have not been surveyed for botanical resources that are also within the proposed burn units. These areas would be surveyed before project activities would take place. No known occurrences of SOLC or Sensitive Plant Species are located in the proposed burn blocks. However, it is possible that unknown occurrences exist in the unsurveyed portion of the burn blocks. The design criteria (Appendix B) would be applied if occurrences are found in unsurveyed areas.

Suitable plant habitat in the Project Area is generally found in cool, moist drainages and on northerly aspects. Wildland fuels in these habitats are exposed to more moisture 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 (Zacharkevics 2007b).

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, increased precipitation, lower fuel temperatures and higher fuel moisture content. By timing the burns in these months, risks to SOLC and Sensitive Plant Species and their habitats are reduced because these burns would likely occur when plants are dormant. By burning during moderate weather conditions, it is possible to contain a prescribed fire without constructing soil disturbing control lines within these moist habitats. Instead, wet lining and black lining can be used to contain the prescribed fire near suitable plant habitats. Black lining can be used where suitable plant habitat occurs within or adjacent to a burn unit.

During implementation, fires would not be ignited within the suitable habitat, but would be ignited in adjacent areas. Because suitable plant habitat typically does not carry fire, the fire that is ignited adjacent to the habitat would likely 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 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 can precede the ignition team to pre-treat vegetation in the suitable habitat by wetting the vegetation with water, making it resistant to fire.

The prescribed fire treatments 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.

Indirect effects of the prescribed burning to suitable plant habitat include a reduced chance of losing these areas to more intense wildfires. Reducing fuels directly adjacent to these habitats through mechanical treatments and prescribed burning may decrease the risk of unnaturally intense wildfires reaching individual plants. This effect could benefit SOLC and Sensitive Plant Species and their habitats.

Effects of Thinning, Piling and Burning of Natural Fuels

Alternative B requires hand thinning (with chainsaws), and piling and burning of natural fuels for a 468 acre area. These treatments would be conducted in the Spearfish Canyon with the objective of creating fuel breaks near the canyon bottom. About 169 acres of identified habitat suitable for SOLC and Sensitive Plant Species would be included within these treatment areas.

These treatments could potentially have a direct effect on SOLC and Sensitive Plant Species and suitable habitat. These potential effects include the loss of individual plants due to the piling and burning of wood, smothering of plants from wood chips, trampling of plants by woods workers, the altering of suitable habitat by changing the canopy cover and the amount of shading and reducing the amount of woody material on the forest floor. Because design criteria include a 30 foot no treatment buffer around known locations of SOLC and Sensitive Plant Species, the potential for loss of known occurrences due to the piling and burning or the chipping of woody fuels would be reduced. Currently, the only known location of an SOLC within these treatment areas is one occurrence of shining willow. This occurrence would be excluded from treatment areas. New occurrences discovered prior to or during implementation of the fuels treatments would also be excluded from the treatment areas within a minimum of a 30 foot no treatment buffer around plant locations. The no treatment buffers around plant occurrences would also reduce the likelihood of plants getting trampled by woods workers. Because it is not possible to survey 100 percent of the area of suitable habitat for individual plant SOLC, there is a risk that unknown occurrences of these plants could be affected by the proposed treatments.

This treatment could reduce the amount of shading in suitable plant habitat, potentially reducing suitable habitat for some SOLC and Sensitive Plant Species in the short-term. The amount of shading from understory conifer trees within treatment areas would be reduced, but the treatments would not remove any larger overstory trees. In many areas the treatments would open up the stands enough to increase the amount of sunlight, moisture and nutrients available for understory plants. This change in canopy cover could alter the moisture and light regimes within some habitats suitable for SOLC and Sensitive Plant Species. The more shade intolerant understory plants would be expected to increase following treatment. Plant species that

require deeper shade could be negatively affected by increased amounts of sunlight and warmer conditions. This effect would be temporary as over time the amount of shade within the treatment areas would be expected to increase. The growth of the crowns of overstory trees as well as the establishment and growth of understory woody plants would increase shading in the future. How these changes in microclimate might affect the suitability of these areas for SOLC and Sensitive Plant Species is not well understood.

Stiff clubmoss is an example of a SOLC plant species that may be sensitive to changes in shading. Stiff clubmoss may be restricted to shaded habitats that retain enough moisture for the plants to survive. It may be that this species is more sensitive to small shifts in microhabitat conditions in the Black Hills than in other parts of its range. The surrounding habitat structure may exert a strong influence on suitable habitat conditions particularly with regards to shade and the amount of available moisture (Hornbeck et al 2003). The one known location of this species within the Project Area does not occur near any of the proposed fuel reduction treatments.

A short-term indirect effect of the proposed fuel reduction treatments is a reduced chance of a hot, high intensity wildfire burning through suitable habitat in and adjacent to these treatment areas. A high intensity burn could remove all shade and alter the soil and hydrologic characteristics of a site. The potential negative effects of a burn that removes all shade from suitable plant habitat could be longer lasting and more extreme than the potential negative effects of the proposed fuel treatments.

Another potential indirect effect of the proposed fuel reduction treatments is the spread of noxious weeds into habitats suitable for rare plant species. Noxious weeds are present within Spearfish Canyon. Seeds from these plants could be carried into suitable habitats on people and equipment entering these areas to conduct the proposed vegetation treatments. Ground disturbance created by the burning of piled fuels may create a suitable seedbed for these weeds and provide an environment suitable for these plants to become established. Design criteria for the project include measures to minimize the spread of weeds. These measures include eliminating the local source of weed seeds, minimizing soil disturbance, and re-vegetating areas of exposed soil with a weed-free native seed mix.

Potential Effects to Yellow lady's slipper (Cypripedium parviflorum)

Alternative B proposes natural fuels reduction treatments within 100 feet of approximately 110 individual plants of yellow lady's slipper. These plants account for 13 percent of the population of this species in the Project Area and four percent of the known plants on the Black Hills National Forest. These plants as well as any new occurrences discovered prior to or during implementation of the fuels treatments would be excluded from the treatment areas, with a minimum of a 30 foot no treatment buffer around plant locations, when feasible. These no treatment buffers would reduce, but not eliminate, the likelihood of plants getting trampled by workers.

How this species might be affected by the proposed fuel reduction treatments is unknown. The factors that limit yellow lady's slipper within the Black Hills are not well understood but may include soil pH, soil moisture, soil fungi, and the amount of light and competing vegetation (Mergen 2006). This long lived perennial may do better in transitional or successional plant communities than in climax communities (Mergen 2006). The variability of the conditions where yellow lady's slipper is found in the Black Hills indicates that

this species can survive in multiple habitats and it may survive at one location long enough for a plant community to change through succession. It is possible that tree removal could alter succession in such a way that proves beneficial to a local population of yellow lady's slipper. This species is suspected to benefit from some canopy removal up to a threshold (Mergen 2006). However, this species is a poor competitor. If opening up the canopy results in an increase in competing vegetation, there may be an adverse affect on local populations of yellow lady's slipper. In addition, increased light may reduce seed germination for this species (Mergen 2006). This species is dependent on associations with mycorrhiza fungi for seed development, seedling development and perhaps even after plants are fully established (Mergen 2006). How the changes in microclimate resulting from the proposed fuel treatments might affect these important soil fungi is not known. The optimum amounts of light, level of competition as well as other specific requirements for this species in the Black Hills are not known.

If it is assumed that all yellow lady's slipper in and adjacent to the treatment areas are adversely affected by the proposed actions, the number of known individuals of this species within the Project Area would drop to 739 plants. While this would be an undesirable effect, it is unlikely to result in the loss of viability of this species within the Project Area or across the Black Hills National Forest. These remaining plants would be located in several different drainages located throughout Spearfish Canyon. Given the longevity of this species and the distribution of the remaining plants, this species would likely still remain as a viable population within the project after treatment.

Effects of Meadow and Hardwood Enhancement Treatments

The objective of these proposed treatments is to maintain aspen, bur oak, and meadow communities by reducing competition from ponderosa pine. The commercial treatments would use heavy machinery for the removal of larger trees. With the non-commercial hardwood and meadow enhancements (both non-mechanized treatments), smaller trees would be removed from aspen and meadow areas and within a 30-foot buffer of these areas. The goal of these treatments is to maintain habitat diversity within the Project Area.

Design criteria do not allow for mechanical treatment in suitable habitat; therefore, direct effects to SOLC and Sensitive Plant Species and suitable habitat are likely to be minimal. However, the possibility still exists for a small amount of overlap with suitable habitat and adjacent mechanical treatment. Potential effects include trampling of individual plants, ground disturbance and soil compaction resulting from use of heavy equipment.

Indirect effects to suitable habitat include the potential for degradation of habitat by invasion or spread of invasive species from ground disturbance in adjacent areas. It is anticipated that there would be more disturbance from commercial hardwood enhancement treatments than with non-commercial (hand) treatments of meadow and hardwood areas. The design criteria include measures to reduce the spread of weed seeds in the Project Area.

Effects of Road Building and Reconstruction

Alternative B proposes 35 miles of new road construction. Road construction may directly and indirectly affect rare plants and their habitat. Construction of roads can degrade habitat, and heavy equipment can crush individual plants. Roads may also act as corridors for the dispersal of invasive weeds.

Alternative B proposes construction of several segments of new road that could potentially run through suitable habitat. No known occurrences of SOLC plant species are within these areas, but there are known occurrences of sensitive plant species. A botanist would work with the road engineers to determine the best placement of these roads considering habitat, known occurrences of Sensitive Plant species and feasibility. However, it is likely that some of the new road would pass through suitable habitat. Degradation of habitats due to road construction would be minimized through implementation of protective measures, associated Forest Plan standards and guidelines, Regional Watershed Conservation Practices (FSM 2509.25), best management practices, and project design criteria.

Summary of Alternative B (Proposed Action) Direct and Indirect Effects to SOLC

It is unlikely that the implementation of the proposed actions would result in the loss of any of the known occurrences of stiff clubmoss, northern hollyfern, or shining willow; or directly affect the persistence of these plant species within the Project Area or on the Black Hills National Forest. The known occurrences of these plant species would be excluded from any treatment areas under this alternative.

Habitats suitable for Mingan moonwort, pleated gentian, broadlipped twayblade and narrowleaf sweet coltsfoot plant species exist within the Project Area but there are no known occurrences of these plant species in the area. Because these SOLC are not known to occur in the Project Area, implementation of the proposed actions would not be expected to have a direct affect on the persistence of these species on the Black Hills National Forest.

Some suitable habitat would likely be altered and unknown occurrences of SOLC could be trampled as a result of the proposed actions. Suitable habitat may be lost due to the proposed new road construction and additional suitable habitat may be altered as a result of the proposed fuel reduction treatments within suitable habitat. There is also a risk that some suitable habitat would be affected by fire as a result of the proposed broadcast burning. The risk of invasive weed species spreading to suitable habitats would also increase as a result of the proposed actions. Because it is not possible to survey 100 percent of the area of suitable habitat for individual plant SOLC, there is a risk that unknown occurrences of these plants could be affected by the proposed treatments. However, implementation of the design criteria would minimize these adverse affects.

Alternative B (Proposed Action) - Cumulative Effects

The cumulative effects analysis assesses the potential cumulative effects of the past, present and future foreseeable actions on the suitable plant habitat and Sensitive Plant Species in the Project Area. The time period used for the analysis is 10 to 15 years. This temporal scale is used since future foreseeable actions beyond this time frame are not known and predicting effects beyond this time period become less certain.

Soil disturbance, introduction of invasive species, stand replacing wildfires, and changes in micro site moisture and hydrologic regimes can negatively affect suitable habitat for Sensitive Plant Species. Historical management in the Black Hills has resulted in changes in suitable plant habitat due to livestock grazing, road building, recreation, mining activities, water diversion, and near extirpation of beaver, all of which have decreased suitability of many areas as habitat for Sensitive Plant Species.

Past activities have spread noxious weeds in the Project Area, primarily along roads and other areas of soil disturbance related to past management activities. Implementation of Alternative B could contribute to the spread of invasive species and noxious weeds from soil disturbing activities in the area of Sensitive Plant Species. Soil disturbing activities associated with this alternative include mechanical treatments for logging, fuel reduction practices, commercial hardwood enhancements, prescribed burning, and road building and 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 Plant Species and their habitats.

Approximately 213 miles of road exist on NFS land in the Project Area. Most of these roads have been present for several decades. Additionally, there are approximately 200 miles of known road on private land. Under this alternative, 35 additional miles of new road would be built bringing the total length of road in the Project Area to approximately 450 miles. These roads could have a cumulative negative effect on Sensitive Plant Species by providing corridors for the dispersal of invasive weeds and providing access for ATVs and other soil disturbing activities. Adherence to the project design criteria, 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 (USDA-Forest Service 2007b). The Forest is currently revising its Travel Management Plan. The new forest-wide plan will designate which routes can be used and for what activities. This plan may reduce the miles of open road in the Project Area. This could help to reduce the cumulative effects of the roads in the area.

Treatments that reduce the potential for crown fires can have a beneficial effect on suitable plant habitat. Management that includes prescribed burning and harvesting of adjacent conifer stands can help maintain a mosaic of seral stages, increase available moisture, and decrease the potential for widespread crown fires. In addition to slowing the spread of crown fires, landscape patchiness resulting from the proposed treatments can provide a strategy whereby both fire-adapted and fire-sensitive species are more likely to be maintained (USDA-Forest Service 2005a).

Implementation of Alternative B, combined with similar actions proposed on adjacent areas, could have a positive cumulative effect on suitable plant habitat in the Project Area by reducing the potential for crown fires and increasing landscape patchiness across a larger area. The Griggs fuel management project is adjacent to the Project Area. This project includes thinning 1,170 acres, prescribed burning 500 acres and the creation of fuel breaks on 326 acres. The Citadel Project Area is also just to the west of the West Rim Project Area. Implementation of this project would begin in the next year. The Citadel project includes vegetative and fuels treatments on 17,780 acres to reduce the density of pine stands and fuel loads. Additional future foreseeable actions include; the Telegraph project just to the south of the West Rim Project Area and Spearfish Canyon 1 and 2 within the Project Area. These projects would address concerns over an increase in mountain pine beetle activity in the area and would involve vegetation treatments similar to those proposed for the West Rim project. These on-going and possible future treatments in adjacent areas could have cumulative effects. These treatments would reduce the risk of a crown fire developing in adjacent areas that could spread into the area and affect suitable plant habitats. However, these activities also have the potential to increase the spread of noxious weeds in adjacent areas that could then spread into the West Rim Project Area.

Determination of Effects

The implementation of Alternative B may adversely impact individuals, but is not likely to result in a loss of viability in the Project Area nor cause a trend towards federal listing of any of the six Sensitive Plant Species that are known to occur or are known to have suitable habitat within the Project Area; foxtail sedge, yellow lady's slipper, large round-leaf orchid, highbush cranberry, trailing clubmoss and bloodroot.

Most of the Project Area has been surveyed specifically for sensitive plant species and suitable plant habitat. The area that has not been surveyed would be surveyed in 2008, prior to implementation of this project and project design criteria would be applied to any suitable habitat or plant occurrences discovered during field surveys.

Implementation of the design criteria for the proposed treatments would minimize the negative impacts to these Sensitive Plant Species and their habitats. No commercial timber harvesting would occur within suitable plant habitat or in areas with known occurrences of any Sensitive Plant Species. Known occurrences of foxtail sedge, large round-leaf orchid, and highbush cranberry occur near areas that would be logged under this alternative. These occurrences would be excluded from the areas of commercial timber harvest and would be protected from any ground disturbing activities associated with the logging on the adjacent sites. There are no known occurrences of sensitive plant species within the proposed prescribed burn blocks. Suitable habitat would not be directly ignited and burning would be conducted when most Sensitive Plant Species are dormant.

The proposed new road construction would likely alter some suitable habitat. A botanist would work with road engineers to minimize the amount of habitat affected. No roads would be built in areas where Sensitive Plant Species are known to exist. This alternative may result in a long term beneficial effect on sensitive species by reducing the risks of hot stand replacing fires within suitable habitats.

Yellow lady's slipper (Cypripedium parviflorum)

The proposed thinning, piling and burning of natural fuels within the Spearfish Canyon have the potential to adversely affect individual plants and suitable habitat. Yellow lady's slipper is the only Sensitive Plant Species known to occur in the areas proposed for the thinning, piling and burning of natural fuels. These plants would be protected with a 30 foot no treatment buffer, when feasible. Based on the number and distribution of occurrences of this species on the Black Hills National Forest it currently appears to be relatively secure in the Black Hills.

A determination of, may adversely impact individuals, but is not likely to result in a loss of viability in the Project Area nor cause a trend towards federal listing, is made for yellow lady's slipper. Even when assuming loss of all individuals near or within the treatment areas, it is anticipated that there would not be a loss in viability for yellow lady's slipper due to the number of known individuals in Spearfish Canyon that would not be impacted (739), the distribution of these remaining individuals (eight or more different drainages), and the number (3,986) and distribution (20 sixth level watersheds) of plants of this species across the Black Hills National Forest.

Alternative C - Direct and Indirect Effects

Alternative C proposes the same treatments as Alternative B with the addition of fuel reduction treatments around privately owned structures across the Project Area and additional thinning, piling and burning of natural fuels within Spearfish Canyon (Table 8). The effects of this alternative on Sensitive Plant Species and SOLC are similar to those described for Alternative B. Additional effects from the creation of 300 foot fuel reduction buffers around privately owned structures as well as the additional fuel treatments within Spearfish Canyon are discussed below. The amount of fuel reduction treatments implemented within 300 feet of structures is dependent on landowners entering into agreements with the Black Hills National Forest. It is likely that only a subset of the buffer areas would be treated. However, the effects analysis assumes full implementation of these buffer treatments. The estimated effects include the effects of the proposed treatments including the implementation of the design criteria.

Effects of Fuel Buffers

Alternative C would add up to 928 acres of fuel reduction treatments to those that are proposed under Alternative B for a total of 1,396 acres of fuel treatments. This alternative would include up to 568 acres of treatment on NFS land within 300 feet of structures in the Project Area and an additional 360 acres of treatment outside of these structure buffers. Most of these treatments would take place within Spearfish Canyon. However, 52 acres of the 568 acres of buffer treatments would be applied around structures outside of the Canyon.

These treatments would consist of cutting trees under nine inches in diameter and removing the bottom limbs up to 15 feet on conifers over nine inches in diameter. Existing ground fuels along with woody fuels created from the cutting of small trees and pruning larger trees would either be hand piled and burned, or chipped. The re-treatment of areas would be allowed within a ten year time frame.

The additional fuels reduction treatments proposed under Alternative C could include treatment within 431 acres of habitat suitable for Sensitive Plant Species and SOLC. Combined with the 468 acres of fuel reduction treatments that are proposed under both Alternatives B and C, there could be up to 600 acres of suitable habitat in the fuel reduction treatment areas.

There are no known occurrences of SOLC or Sensitive Plant Species in these additional treatment areas. However, there is a portion of the 600 acres that has not been surveyed for suitable habitat. It is possible that additional SOLC or Sensitive Plant Species exist in this unsurveyed area. Therefore, these treatments have the potential to directly affect SOLC plant species and suitable habitat. As with the fuel reduction treatments proposed under Alternative B, these potential effects include; the loss of individual plants due to the piling and burning of wood near or on plant occurrences, smothering of plants from wood chips, the trampling of plants by woods workers or the altering of suitable habitat by changing the canopy cover and the amount of shading. Because design criteria include a 30 foot no treatment buffer around known locations of SOLC and Sensitive Plant Species when feasible, the potential for loss of known occurrences due to the piling and burning or the chipping of woody fuels would be reduced. However the risk of damage to unknown occurrences of SOLC and Sensitive Plant Species is higher for Alternative C than Alternative B because a larger area of suitable habitat would be within treatment areas.

Potential Effects to Yellow lady's slipper (Cypripedium parviflorum)

Alternative C proposes fuel reduction treatments in or within 100 feet of 265 yellow lady's slipper plants. These plants account for 31 percent of known plants of this species within the Project Area and seven percent of the known plants on the Black Hills National Forest. When feasible, these plants as well as any new occurrences discovered prior to or during implementation of the fuels treatments would be excluded from the treatment areas within a minimum of a 30 foot no treatment buffer around plant locations. How this species might be affected by the proposed fuel reduction treatments is discussed for Alternative B.

If it is assumed that all yellow lady's slipper within and adjacent to the treatment areas are killed as a result of the proposed actions, the number of known individuals of this species within the Project Area would drop to 584 plants. While this would be an undesirable effect, it is unlikely to result in the loss of viability of this species within the Project Area or across the Black Hills National Forest. These remaining plants are located in several different drainages within Spearfish Canyon. Given the longevity of this species and the distribution of the remaining plants, this species would likely still remain as a viable population within the area after treatment.

Alternative C - Cumulative Effects

See the discussion of cumulative effects for Alternative B for the effects of those treatments that Alternatives B and C have in common. Alternative C would have additional cumulative effects from the on-going fuel treatments in the Spearfish Canyon in combination with the fuel treatments proposed under this alternative. Spearfish Canyon is an on-going project that is creating several fuel breaks within the canyon adjacent to Highway 14A. This project would create a half mile long fuel break near the mouth of the canyon and another mile long break near Savoy. Like the fuel break treatments proposed by Alternative C, these on-going treatments would remove the ground and ladder fuels within treatment areas. The amount of understory vegetation would be reduced within these breaks. These treatments, in combination with the fuel breaks proposed under Alternative C, could have a cumulative effect on SOLC and Sensitive Plant Species and suitable plant habitat within Spearfish Canyon. The creation of fuel breaks could reduce the probability of a wildfire spreading into the crowns of the overstory trees. Fires that burn in the crowns of overstory trees can burn hotter and spread faster than a ground fire. Preventing the development of this type of fire would help prevent degradation of suitable habitats and the loss of plant occurrences due to hot wildfires. However, the proposed vegetation treatments could result in a short term reduction in the amount of suitable habitat for some Sensitive Plant Species by reducing the canopy cover and changing the amount of shade within treatment areas.

Determination of Effects

Implementation of Alternative C, may adversely impact individuals, but is not likely to result in a loss of viability in the Project Area nor cause a trend towards federal listing of any of the six Sensitive Plant Species that are known to occur or are known to have suitable habitat within the Project Area: foxtail sedge, yellow lady's slipper, large round-leaf orchid, highbush cranberry, trailing clubmoss and bloodroot. This determination was made based on the following rationale. Most of the Project Area has been surveyed

specifically for sensitive plant species and suitable plant habitat. The area that has not been surveyed would be surveyed prior to implementation of any of the proposed actions and applicable project design criteria would be applied to any suitable habitat or plant occurrences discovered during field surveys.

Implementation of the design criteria for the proposed treatments under this alternative would reduce the negative impacts to these Sensitive Plant Species and their habitats. No commercial timber harvesting would occur within suitable plant habitat or in areas with known occurrences of any Sensitive Plant Species. Known occurrences of foxtail sedge, large round-leaf orchid and highbush cranberry occur near areas that would be logged under this alternative. These occurrences would be excluded from the areas of commercial timber harvest and would be protected from any ground disturbing activities associated with the logging on the adjacent sites. There are no known occurrences of sensitive plant species within the proposed prescribed burn blocks. Suitable habitat would not be directly ignited and burning would be conducted when most Sensitive Plant Species are dormant.

The proposed new road construction would likely alter some suitable habitat. A botanist would work with road engineers to minimize the amount of habitat affected. No roads would be built in areas where Sensitive Plant Species are known to exist. This alternative may result in a long term beneficial effect on sensitive species by reducing the risks of hot stand replacing fires within suitable habitats.

Yellow lady's slipper (Cypripedium parviflorum)

The proposed thinning, piling and burning of natural fuels within the Spearfish Canyon have the potential to adversely affect individual plants and suitable habitat. Yellow lady's slipper is the only Sensitive Plant Species known to occur in the areas proposed for the thinning, piling and burning of natural fuels. These plants would be protected with a thirty-foot no treatment buffer, when feasible. Based on the number and distribution of occurrences of this species on the Black Hills National Forest it currently appears to be relatively secure in the Black Hills. Thirty-one percent of known individuals of this species within the Project Area may be affected by the proposed treatments under Alternative C. These individuals account for seven percent of the individual plants of this species currently known to occur on the Black Hills National Forest. There are plants of this species that are not within or near the proposed fuels treatment areas and would not be impacted by the proposed treatments. These plants are located in several different drainages located throughout Spearfish Canyon.

A determination of "may adversely impact individuals, but is not likely to result in a loss of viability in the Project Area nor cause a trend towards federal listing" is made for yellow lady's slipper. Even when assuming loss of all individuals near or within the treatment areas, it is anticipated that there would not be a loss in viability for yellow lady's slipper due to the number of known individuals in Spearfish Canyon that would not be impacted (584), the distribution of these remaining individuals (eight different drainages), and the number (3,986) and distribution (20 sixth level watersheds) of plants of this species across the Black Hills National Forest.

3.7 Noxious and Invasive Weeds

3.7.1 Existing Conditions for Noxious and Invasive Weeds

The most recent monitoring report prepared for the Black Hills National Forest suggested that there are about 100,000 acres of NFS land within the boundaries of the Black Hills National Forest that have been infested by noxious weeds (USDA-Forest Service 2007a). The report recognizes that it is difficult to determine the acreage that is infested but that inventory methods and tracking continue to improve. Inventories completed in 2003 and 2004 showed that 749 acres of noxious weeds exist in the West Rim Project Area. Known weed species found in the Project Area are displayed in Table 33.

3.7.2 Environmental Consequences for Noxious and Invasive Weeds

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

Historically, disturbed areas such as roads, skid trails, landings, and burn piles have been the areas most susceptible to infestation. A review of timber sales indicates that we can expect three percent of the total treated acres in a timber sale to be infested by noxious weeds. For each road, an area including the width of the road and approximately five feet on either side of its running surface is capable of supporting noxious weeds until revegetation occurs. Of the total miles of road constructed, it is estimated that approximately 10 percent would become infested with weeds.

Design criteria (Appendix B) would allow effective management of noxious weeds throughout project implementation. These criteria would meet Forest Plan objectives 230 and 231, as they relate to eradication, control and prevention of noxious weeds. The effects analysis presented below assumes that relevant weed prevention practices are implemented.

Table 33. Noxious Weeds in the West Rim Project Area

Common Name	Area in Project Area (acres)
Canada thistle	397.0
Hounds tongue	103.0
Yellow toadflax	0.3
Musk thistle	4.3
Common mullein	50.5
Common tansy	41.4
St. Johnswort	144.8
Spotted Knapweed	8.0

Alternative A (No Action) - Direct and Indirect Effects

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

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

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Alternative B includes approximately 17,363 acres of commercial/non-commercial vegetation treatment. It also calls for 13,226 acres of prescribed fire. In addition, this alternative proposes the construction, reconstruction or maintenance of approximately 161 miles of road.

Alternative C would include treatments and monitoring for all activities in Alternative B but would also include additional activities, such as fuel reduction by burning and piling activities around private structures, which could increase noxious weeds on NFS lands.

Noxious weed infestations are expected to increase under Alternatives B and C. 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 soil disturbance occurs, the potential for the establishment of noxious weeds exists. The potential for noxious weed establishment is even greater in disturbed areas adjacent to existing weed populations. The movement of equipment in and out of these areas also facilitates weed establishment. Roads create a network of corridors through which seed dispersal can occur.

A ten-year review of timber sales estimated that between 2.0 and 3.5 percent of the area in a timber sale are likely to develop weed infestations (USDA-Forest Service 1996b). For this analysis, three percent of all treatment activities with the exception of acres of prescribed fire were used to estimate the acres of infestation that are likely to result from harvest activities. New road construction and reconstruction would result in approximately 0.12 acres of new weed infestation per mile of road (USDA-Forest Service 1996b). Alternatives B and C would both lead to approximately 454 acres of new infestation.

Additional acres may be infested by noxious weeds as a result of prescribed fire activities. 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 no formula to estimate how many acres of infestation might result from such activities. A number of variables including soil temperature, fire intensity, and time of year can influence the effect that prescribed fire can have 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 likely 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 before 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.

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 can increase the risk and rate of spread for many weed species. Resource damage that can result 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 off-road motorized travel due to expansion of the road system and removal of vegetation allowing access to new areas.

All Alternatives - Cumulative Effects

The cumulative effects analysis area for noxious weeds is the Project Area plus private land inholdings. Previous 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; these types of activities are expected to continue, providing the potential for additional noxious weed infestations. 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 similar to those on NFS lands.

Noxious weeds resulting from previous actions will continue to be treated and monitored. An increase in infested acres would have negative impacts both ecologically and economically. An increase in the area of infestation leads to 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 mostly impacts grass/forb communities, specifically riparian areas, upland grasslands, and meadows. When these areas become infested with noxious weeds, forage for wildlife and livestock is reduced.

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

3.8 Range

3.8.1 Existing Conditions for Range

The West Rim Project Area contains all or portions of 11 different grazing allotments. The names of the allotments, along with a brief description of each, are provided below:

- **Bear Ridge Allotment:** The Bear Ridge Allotment consists of 5,376 acres, 27 of which are within the West Rim Project Area. For this allotment there are 3 grazing permits. A total of 102 cow/calf pair have a permitted season of use from 6/16 to 9/20 on a 2 pasture deferred rotation grazing system.
- **Buskala Allotment:** The Buskala Allotment consists of 11,947 acres, 530 of which are within the West Rim Project Area. For this allotment there is 1 grazing permit. A total of 148 cow/calf pair have a permitted season of use from 6/7 to 10/11 on a 5 pasture deferred rotation grazing system.
- **Deadman Allotment:** The Deadman Allotment consists of 2,668 acres, 519 of which are within the West Rim Project Area. For this allotment there are 2 grazing permits. A total of 159 cow/calf pair have a permitted season of use from 6/16 to 10/1 on a 2 pasture deferred rotation grazing system.

- **Griffith Allotment:** The Griffith Allotment consists of 5,685 acres, 751 of which are within the West Rim Project Area. For this allotment there is 1 grazing permit. A total of 140 cow/calf pair and 60 yearlings have a permitted season of use from 6/16 to 10/15 on a 5 pasture deferred rotation grazing system.
- **Higgins Gulch Allotment:** The Higgins Gulch Allotment consists of 15,664 acres, 941 of which are within the West Rim Project Area. For this allotment there are 5 grazing permits. A total of 206 cow/calf pair have a permitted season of use that varies from 6/16 to 9/20 on a 2 pasture deferred rotation grazing system.
- **Little Spearfish Allotment:** The Little Spearfish Allotment consists of 9,181 acres, 96 of which are within the West Rim Project Area. For this allotment there is 1 grazing permit. A total of 330 cow/calf pair have a permitted season of use from 6/11 to 9/30 on a 9 pasture deferred rotation grazing system.
- **Pettigrew Allotment:** The Pettigrew Allotment consists of 7,504 acres, 4,067 of which are within the West Rim Project Area. For this allotment there is 1 grazing permit. A total of 324 cow/calf pairs have a permitted season of use from 6/16 to 9/20 on a 2 pasture deferred rotation grazing system.
- **Plateau Allotment:** The Plateau Allotment consists of 16,493 acres, 12,155 of which are within the West Rim Project Area. For this allotment there are 4 grazing permits. A total of 333 cow/calf pairs have a permitted season of use from 6/16 to 9/30 on a 2 pasture deferred rotation grazing system.
- **Ragged Top Allotment:** The Ragged Top Allotment consists of 15,842 acres, 10,785 of which are within the West Rim Project Area. This allotment is vacant; no livestock are currently permitted.
- **Tollgate Allotment:** The Tollgate Allotment consists of 11,195 acres, 7,563 of which are within the West Rim Project Area. For this allotment there are 3 grazing permits. A total of 296 cow/calf pair have a permitted season of use from 6/16 to 9/20 on a 2 pasture deferred rotation grazing system.
- **Wildcat Allotment:** The Wildcat Allotment consists of 13,320 acres, 5,111 of which are within the West Rim Project Area. For this allotment there is 1 grazing permit. A total of 184 cow/calf pair have a permitted season of use from 6/15 to 10/15 on a 3 pasture deferred rotation grazing system.

3.8.2 Environmental Consequences for Range

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.

Alternative A (No Action) - Direct and Indirect Effects

Under the no action alternative, there would be few direct or indirect effects on the range resource and no effect on current allotment management. Loss of primary grazing areas could result from pine encroachment

into meadows or other primary grazing areas. As these trees mature and canopy cover and needle cast increases, current grass/forb communities may decrease in health and vigor as available light needed for photosynthesis is reduced. Encroachment of ponderosa pine into grassland communities, meadows and riparian areas increase the grazing pressure on these areas as they shrink in size. This would ultimately reduce their capability under the current permitted livestock numbers. Utilization guidelines described in the Allotment Management Plan (AMP) and Annual Operating Instructions (AOI) may eventually be exceeded making it difficult to maintain satisfactory condition in some areas. Current transitory range would also decrease due to shading from the timber overstory, which would limit growth of forage species.

Alternative A (No Action) - Cumulative Effects

The cumulative effects analysis area for the range resource is the total area of all the allotments that fall within or overlap the West Rim Project Area. This includes the 11 allotments identified above and totals approximately 42,550 acres. The timeframe considered for analysis is from 10 years in the past until 10 years in the future (1998-2018).

Allotment management would not be affected by the West Rim project as the level of grazing for each allotment is determined through a separate NEPA analysis.

In grassland areas that were not cleared of encroaching ponderosa pine under the past timber sales listed in Table 11, the cumulative effect of taking no action in the West Rim project would be a continued loss of grassland communities, and consequently grazing forage, to pine encroachment.

Additionally, those forested areas not treated under recent timber sales could experience the cumulative effect of increased fire hazard if no vegetation management actions occurred under the West Rim project. High intensity fire could have widespread negative effects on allotment conditions (e.g., short-term loss of forage, long-term risk of increased noxious weed infestation, increased erosion and sedimentation affecting water sources), possibly altering conditions to the point that established AMPs and AOIs would no longer be feasible.

Alternative B (Proposed Action) and Alternative C - Direct and Indirect Effects

Removal of timber through commercial and noncommercial treatment provides transitory range. Transitory range is an area that temporarily shows an increase in forage production as a result of increased light and water becoming available to grass/forb plant communities. Even though transitory range tends to be short lived due to the rapid regeneration of pine seedlings, it can aid in livestock distribution by pulling livestock out of primary grazing areas due to the increase in available forage. The impacts by livestock to the primary range (usually located in meadows, upland grasslands and riparian areas) would lessen as cattle distribute themselves throughout the transitory range.

Removal of timber and new road construction can also give livestock access to portions of the allotment that were not previously accessible to them. This may lead to the need for more fencing, or other means to control livestock movement. Any roadwork proposed should consider the access needs of permittees and Forest Service personnel. Permittees need access to maintain improvements such as fences and water developments and to manage livestock grazing. Improvements are often accessed through unclassified roads that could be

closed for all or part of the year with administrative access given to the permittees. Roads also have direct impacts on vegetation by removing it and indirect impacts by aiding the establishment of noxious weeds (see *Section 3.7 Noxious and Invasive Weeds*).

Project activities such as mechanical treatment and prescribed fire could increase and improve browse and forage. Short-term impacts associated with removal of a portion of the timber canopy include increases in the availability of secondary forage available for livestock. Prescribed fire may temporarily change the current allotment management. To avoid any conflicts with grazing and to ensure that prescribed fire mitigation is implemented, prescribed fire activities would be coordinated in advance with the District range management specialist. The allotments in which prescribed fire treatments are planned are on a deferred rotation grazing system. Scheduling of prescribed burns and the rotation and season of use by livestock would be coordinated to ensure that adequate re-growth of forage species is accomplished.

Alternative B (Proposed Action) and Alternative C - Cumulative Effects

The cumulative effects analysis area for the range resource is the total area of all the allotments that fall within or overlap the West Rim Project Area. This includes the 11 allotments identified above and totals approximately 42,550 acres. The timeframe considered for analysis is from 10 years in the past until 10 years in the future (1998-2018).

Previous and foreseeable timber harvest has created and would continue to create transitory range, improving livestock distribution and forage availability. This reduces the time livestock spend on primary range, helping to contribute to Forest Plan objectives 301 and 302 and meet standard 2505. Most harvested areas have, however, quickly regenerated with pine seedlings, 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 Alternatives B and C, creation of transitory range would have a positive cumulative effect on those allotments by reducing the time livestock spend in riparian areas. Broadcast burning proposed under Alternatives B and C 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 effects to rangeland resources presented here would be limited in intensity and duration. Any negative impacts would be minimal and are directly related to livestock management in the short term as they are impacted by treatment activities.

3.9 Hydrology and Soils

3.9.1 Introduction

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

some instances to conform to national standards. A crosswalk of the old sixth level watersheds, new sixth level HUC watersheds, and new seventh level watersheds is provided in Table 34. The Project Area lies within portions of seven 7th level HUC watersheds and three new sixth level HUC watersheds (Figure 10). The total watershed area is greater than the Project Area because portions of the watersheds are located outside of the Project Area boundaries.

Table 34. Sixth and Seventh-Level Hydrologic Units (HU) for the West Rim Project Area.

HU Name - 6th Level	Forest Plan Watershed #	HU Code - 7th Level	7th Level acres	Project Area % of HUC7
Lower Spearfish Creek	8503	10120203030403	11369	74.0
Middle Spearfish Creek	8503, 8501	10120203030204 10120203030203 10120203030202 10120203030201	9,737 8,310 8,102 5,710	99.9 99.8 99.6 95.3
Upper Spearfish Creek	8501	10120203030104 10120203030103	6,430 6,755	100.0 100.0

Beneficial Uses

The South Dakota Department of Environment and Natural Resources (SDDENR 2006) has assigned beneficial or protected uses of the surface waters in the Project 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 would be protected to prevent impairment of those beneficial uses.

The SDDENR is currently seeking public comments on the draft 2008 South Dakota Integrated Report for Surface Water Quality Assessment. The biennial report provides an assessment of the quality of state surface water resources and identifies the impaired waterbodies that require Total Maximum Daily Loads (TMDLs).

Protection of Wetlands

Executive Order 11990 directs all federal agencies to avoid impacts to wetlands. The US Army Corps of Engineers protects wetlands under the Clean Water Act Section 404 regulations. The local regulatory source protection for wetlands is found in the Administrative Rules of South Dakota, Chapter 74:51:01:11. Protection of wetlands as water of the state. The provisions of §§ 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 wetlands.

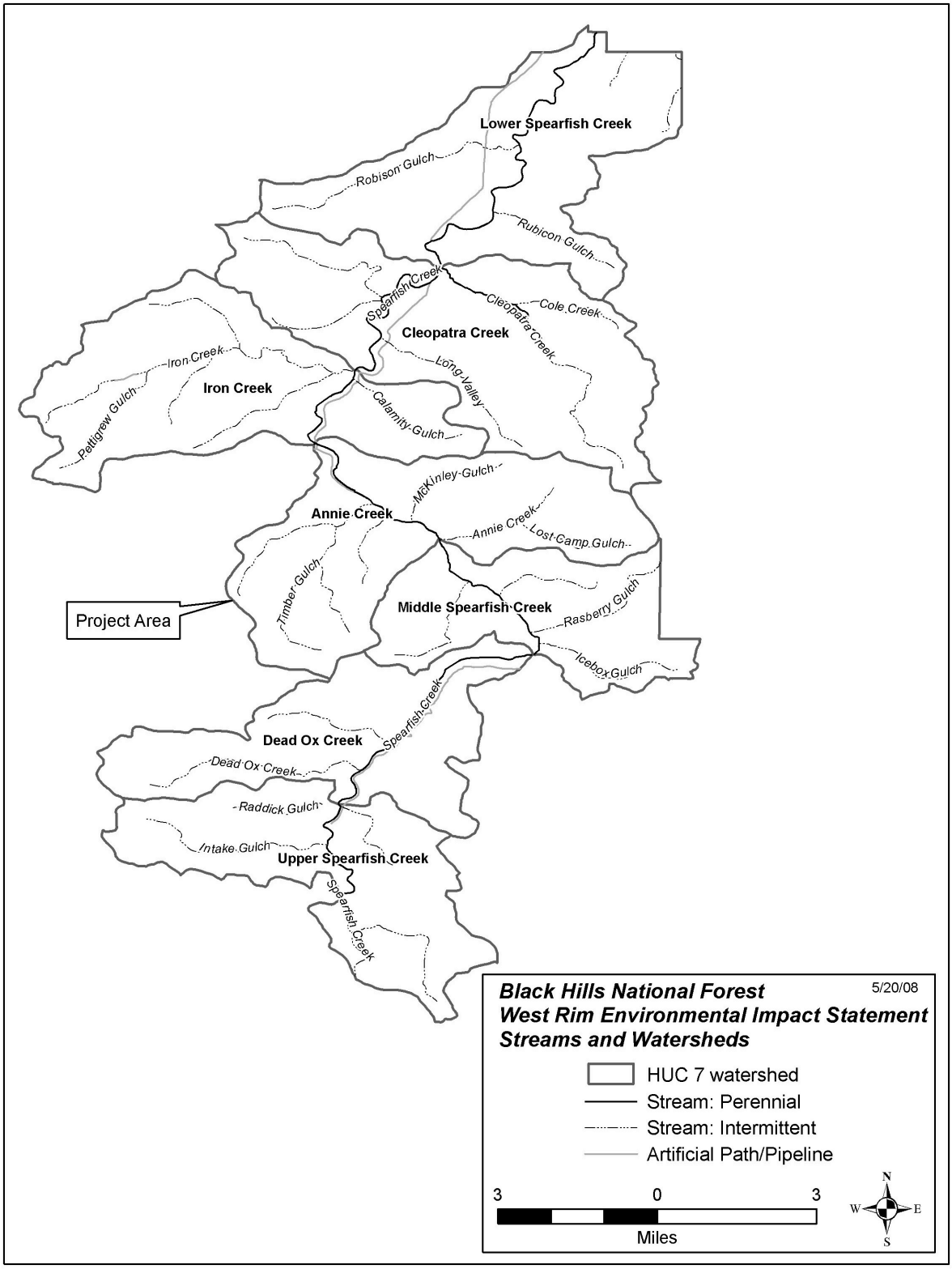

Figure 10. West Rim Project Area Watersheds

Floodplain Management

Executive Order No. 11988 requires federal agencies to provide leadership and to take action to:

- minimize adverse impacts associated with occupancy and modification of floodplains and reduce risks of flood loss;
- minimize the impacts of human safety, health, and welfare; and
- restore and preserve the natural and beneficial values served by floodplains.

3.9.2 Existing Conditions for Hydrology and Soils

The natural characteristics of a watershed, such as annual precipitation, topography, soil types, geology, and vegetative cover are primary contributors to the extent ground disturbing activities are expected to affect channel morphology, flow regime, water quality, and ultimately downstream beneficial uses. These topics are discussed below for the West Rim Project Area.

Climate and Topography

The average annual maximum air temperature is 59 degrees Fahrenheit. The average annual precipitation for this area is about 21 inches. Winter precipitation (October 1- April 30) is about 8 to 9 inches and 11 to 12 inches of precipitation occur during the summer period of May 1-September 30 (WRCC 2008). There is some potential for rain-on-snow events that may induce peak streamflows. These high flows are important for conserving natural channel morphology conditions. However, where stream channel conditions are unstable these flows can contribute to further degraded stream channel conditions, as well as damage to road drainage and stream crossing structures.

The West Rim Project Area is located on four different landtype associations:

- **Limestone Canyon Lands.** "This landtype association has narrow ridges, very steep sideslopes, narrow valley bottoms and rock outcrops. Sideslopes generally are steeper than 40 percent. The valley bottoms generally are less than 300 feet in width." (USDA-Forest Service 1996a, Appendix K)
- **North Gently Dipping Plateau Lands.** "This landtype association has broad and narrow ridges and valley bottoms, moderately sloping to steep sideslopes and rock outcrops. Sideslopes dominantly have slopes of 15-30 percent. Rock outcrops of sandstone and limestone comprise 10-15 percent of this unit." (USDA-Forest Service 1996a, Appendix K)
- **Steeply Dipping Plateau Lands**. "This landtype association has broad ridges, steep to very steep sideslopes, narrow valley bottoms and rock outcrops. Sideslopes dominantly have slopes of 30 to 50 percent. Rock outcrops of sandstone, limestone and some shale comprise 1 to 20 percent of the unit. The valley bottoms generally are less than 300 feet in width." (USDA-Forest Service 1996a, Appendix K)
- **Volcanic Hills and Ridges.** "This landtype association has broad and narrow ridges, steep to very steep sideslopes, narrow valley bottoms and rock outcrops. Sideslopes dominantly are 30-45 percent slopes.

Valley bottoms generally are less than 300 feet in width. Rock outcrops comprise 10 to 29 percent of this association." (USDA-Forest Service 1996a, Appendix K)

Soil Existing Conditions

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. An analysis of these factors that is based on information summarized in the Natural Resource Conservation Service (NRCS) Soil Data Mart Database (http://soildatamart.nrcs.usda.gov, May 2007) is presented in West Rim Project Hydrology/Soils Resource Report (JW Associates 2008f) for soil map units comprising surveyed units in which Soil Health Assessments were conducted in 2007. The individual factors are discussed in more detail below.

Soil Disturbance (Erosion and Compaction)

Soil compaction is a physical change in soil properties that results in a decrease in porosity and an increase in soil bulk density and soil strength. Observed skid trails, landings, and non-system roads were considered in estimating the extent of existing soil compaction. Roads that are part of the permanent transportation system were not included (WCP Handbook direction) in estimates of soil compaction or detrimental disturbance, according to the 2007 summary letter report for the West Rim Project Area Soil Health Monitoring Assessment completed by the USFS. All eight timber sale units surveyed during the soil health assessments were rated as "Functioning Properly" with respect to soil compaction, but considered "At Risk" for soil erosion. The At Risk label for surface erosion was due mainly to the presence of pedestalled mature plants, and the presence of rills and gullies. The majority of these occurrences were found on unclassified roads (U-roads), skid trails, and in some circumstances on very steep slopes. However, pedestalling, and rill and gully erosion observed on the units was minimal and covered less than 15 percent of the entire surveyed unit. Therefore, all sites were given an overall assessment rating of Properly Functioning. In addition, the presence of effective ground cover necessary to keep soil erosion within tolerable limits was observed for all surveyed units.

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 1996a). Although nutrient removal caused by harvesting has occurred within the Project Area, past events in the Project Area are generally expected to have had limited effects on soil nutrients.

Retaining fine (less than three inches in diameter) slash may be advisable in some stands where soil effective rooting depth is less than 15 inches or topsoil organic matter is less than two percent. Only one soil map unit (40B) has a restrictive layer present at 10-20 inches in depth (USDA Natural Resources Conservation Service 2007). Additionally, all the soil map units comprising surveyed units assessed in the 2007 soil health assessment have a component that may have topsoil organic matter less than two percent.

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 1996a). Burned sites are located on two of the eight units surveyed during the soil health assessments. Although severely burned soil was identified for Rim Rock Sale Unit 15 and Tollgate Sale Unit 6, both units were rated as "Properly Functioning" in the Forest Service summary letter report for the soil health monitoring assessments. The severely burned areas were created by pile burning and therefore they were a small percentage of the total area surveyed.

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 1996a). 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 (JW Associates 2008a). Timber production and growth is addressed in the West Rim Project Silviculture Resource Report (JW Associates 2008a).

Mass Movement

Timber harvesting and road construction disturbance activities have the potential to accelerate erosion, and in steep terrain, mass wasting. Although the mass wasting potential for the Project Area has not been assessed, none was observed during the soil health assessments. Forest Plan Guideline 1108 provides direction for completing on-site slope-stability examinations 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 most or all the timber canopy. Approximately 33 percent of the Project Area is on Citadel or Vanocker-Citadel association soils. A slope stability survey has not been conducted for the West Rim Project Area. On-site slope stability examinations would be conducted before timber harvesting and road construction begins on potentially unstable soils.

Existing Stream Conditions

Streams are complex and dynamic natural systems. The physical, chemical and biological conditions that exist between their banks and cross their floodplains are the result of the natural and man-made characteristics within the watershed. Streams within the West Rim Project Area are identified in Table 35 and displayed in Figure 10.

Table 35. Streams in the West Rim Project Area

HU Code 7th Level	Named Streams within the Project Area	Total Stream Miles in Project Area
10120203030403	Spearfish Creek, Robinson Gulch, Maurice Gulch, Rubicon Gulch	24.6
10120203030204	Eleven Hour Gulch, Cleopatra Creek, Spearfish Creek, Cole Creek, Redpath Creek, Long Valley, Labrador Gulch, East Branch Cleopatra Creek	31.6
10120203030203	Iron Creek, Deer Creek, Spearfish Creek, Calamity Gulch, Prospect Gulch, Johnson Gulch, Pettigrew Gulch	25.7
10120203030202	McKinley Gulch, Spearfish Creek, Annie Creek, Timber Gulch, Lost Camp Gulch	20.3
10120203030201	Spearfish Creek, Sweet Betsey Gulch, Raspberry Gulch, Icebox Gulch	16.5
10120203030104	Spearfish Creek, Hellsgate Gulch, Deadhorse Gulch, Dead Ox Gulch	12.8
10120203030103	Spearfish Creek, Raddick Gulch, Intake Gulch	19.1
	Total	150.5

Streamflow Regime

Peak flows in the Black Hills result from both rainfall and snowmelt. An examination of annual peak flows by the USGS indicates that rainfall-only peaks account for 90 percent of the peak flows in the Black Hills (USDA-Forest Service 2007g). Thus, most stream altering condition floods in the Black Hills are generally associated with high intensity spring and summer thunderstorm events. Approximately 50 percent of the annual precipitation occurs in the months of April, May and June. According to GIS analysis, approximately 34 miles of perennial streams and 117 miles of intermittent streams exist in the Project Area.

Water Quality

Water quality refers to the physical, chemical, and biological composition of a water body and how these components affect beneficial uses. The existing water quality of the streams within the Project Area is a result of the natural characteristics of the watersheds along with the past and current management activities (timber, grazing, recreation, etc.) and the private activities (grazing, construction, mining, etc.) that have occurred. Adverse changes in the water quality caused by activities in the watershed can adversely affect the water body's support of beneficial uses.

Eight stream segments and one lake within the West Rim HUC 6 watersheds were assessed for the 2006 State Water Quality Assessment (SDDENR 2006). Two segments of Spearfish Creek near Elmore, South Dakota, within the Project Area, were rated by the state of South Dakota as non-supporting of their coldwater

permanent fish life use due to elevated pH (SDDENR 2006). High pH levels in these stream segments are believed to be natural and largely due to limestone formations along the stream course. The draft 2008 SDDENR water quality assessment has both creek segments listed as "Full-Threatened" support rather than "Non support". All other reaches of Spearfish Creek, as well as Annie and Cleopatra Creeks, are currently rated as fully supporting of their assigned beneficial uses. Iron Creek Lake is fully supporting some of its assigned beneficial uses; however, there is insufficient data to determine whether or not its immersion recreation or limited contact recreation uses are being supported. The draft 2008 SDDENR water quality assessment lists Iron Creek Lake as fully supporting all of its assigned beneficial uses.

Floodplains and Riparian Areas

Floodplains are defined as "the flat area adjoining a river channel constructed by the river in its present climate and overflowed at times of high discharge" (Dunne and Leopold 1978). Periodic flooding in this area encourages the growth of riparian vegetation, which in turn slows erosion and traps sediment. Floodplains within the Project Area vary from very limited where streams are small and steep to large where streams are larger such as in Spearfish Canyon. A more detailed discussion of riparian areas can be found in the Wildlife Resource Report for the West Rim Project (JW Associates 2008c).

Wetlands

The majority of wetlands in the Project Area are bogs and fens based upon the data in the National Wetlands Inventory. However, the largest area of wetlands is associated with lakes.

Watershed Condition Classes

Watershed classes were assigned to sixth level watersheds during revision of the Black Hills National Forest Land and Resource Management Plan (USDA-Forest Service 1996a). The condition classes were assigned by comparing natural sensitivity and impact indexes (data and mapping exercises used in the analysis for the Forest Plan revision) and monitoring information. The sensitivity and impact indexes are described in Appendix J of the 1996 Forest Plan FEIS. Forest Plan watersheds 8501 (Upper Spearfish Creek) and 8503 (Lower Spearfish Creek) were assigned condition classes II and III, respectively. The 8503 watershed (Lower Spearfish Creek) includes the HUC 7 watersheds of Lower Spearfish Creek, Cleopatra Creek and Iron Gulch (Figure 10).

"*Class 2 watersheds are those which may have streams and soils in disequilibrium. A change in the rate or nature of management activity, stricter implementation of Watershed Conservation Practices and BMPs, or minor structural projects should be able to return these watersheds to a Class I condition. Some upland restoration may be necessary.*" (USDA-Forest Service 1996a)

Class III watersheds 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 can improve the health of the watershed, must be part of project planning. The location and extent of the activity must be carefully analyzed*." (USDA-Forest Service 1996a, Appendix J)

The Black Hills National Forest has determined that management activities can occur in a Class III watershed as long as they meet the following requirements:

- the activities do not degrade the watershed further,
- the activities demonstrate that watershed improvement is targeted by successfully eliminating some of the existing Connected Disturbed Areas (CDAs) currently known to occur within the Project Area,
- that activities and project design show overall improvement (e.g. decommissioning some of the existing road mileage),
- and that if watershed improvement project needs are identified during the project data gathering or planning process, that if feasible, those activities be considered for inclusion within the proposed actions for the Project Area.

Stream Health

Stream health is a combination of biological, physical and chemical characteristics that are assessed to judge a stream's overall condition. Stream health assessments were completed on streams within the Project Area. These assessments looked at bank stability, riparian vegetation, current and historical impacts, and other factors. Overall stream health ratings were not part of the stream health surveys. The stream health surveys are a one time assessment of the streams through field notes and photo documentation.

Based on biological characteristics, principally the occurrence of fish, Project Area streams are likely "Functioning Properly". Suitable fish habitat in the Project Area includes the following perennial streams: Spearfish Creek, all of Annie, Cleopatra and Iron Creeks and Icebox, Intake, Raddick and Rubicon gulches on the Northern Hills Ranger District. Iron Creek Lake and the Yates Pond Complex also provide suitable fish habitat (JW Associates 2008c). Populations of desirable non-native fish (e.g. trout) occur as a result of past fish stocking efforts. However, mountain sucker, a native species, has been documented in Annie Creek (JW Associates 2008d). For more information on fish species and their occurrence within the Project Area, please refer to the West Rim Project Wildlife and Fisheries Resource Report (JW Associates 2008c).

Chemical characteristics would indicate that the streams in the Project Area are of generally good water quality. All streams fully support the designated beneficial uses (draft SDDENR 2008).

Physical characteristics indicate the streams are generally Functioning Properly, with a few exceptions. Forest Plan watersheds 8501 and 8503 were determined to be condition classes II and III, respectively.

Synthesis of these stream health factors results in a composite stream health rating of Functioning Properly for the streams within West Rim Project Area.

Connected Disturbed Areas

Connected Disturbed Areas (CDAs) is a measurement of sediment sources near streams that have a physical connection to streams (USDA-Forest Service 2006a). CDAs may include bare and compacted soils, roads, severely burned areas or mine spoils. When runoff from these disturbed areas flows into a water body, it is connected to the water body. CDAs can contribute sediment to streams or wetlands that could contribute to or result in degradation of physical function, degraded water quality, and increased peak flows that may alter physical channel processes. Roads that cross streams can create a CDA; however, the amount of sediment contributed by the CDA can be limited or minimized through the use of appropriate Best Management

Practices, such as routing ditches that move water and sediment into the forest or filter strips before the stream crossing. Forest Service Handbook 2509.25 Chapter 10 directs the Forest Service to "*progress toward zero connected disturbed area as much as feasible.*"

Existing CDAs were assessed using field surveys completed during the summer and fall of 2007 on all road crossings in the Project Area. From those data, it was estimated that 11 CDAs exist in the Project Area (Table 36). Of the 11 CDAs identified, seven are within a Condition Class II watershed and four are within a Condition Class III watershed.

Table 36. West Rim Project Area Connected Disturbed Areas (CDAs)

Crossing ID	HUC 7 Watershed Name	Road	Stream	CDA
ANN0701	Annie Creek	215	Annie Creek	1
ANN0702	Annie Creek	215	Annie Creek	1
ICN0701	Iron Creek	U0501116	Iron Creek	1
ICN0703	Iron Creek	unknown	Iron Creek	1
ICN0704	Iron Creek	222.2	Iron Creek	1
ICN2utrib0701	Iron Creek	134.2R	Iron Creek	1
SJG0701	Middle Spearfish Creek	733.2A	Jackass Gulch (S. Fork)	1
SJG0703	Middle Spearfish Creek	733.2H	Jackass Gulch (S. Fork)	1
SFC2utrib0702	Upper Spearfish Creek	209.2H	Spearfish Creek	1
SFC3utrib0701	Upper Spearfish Creek	209	Spearfish Creek	1
NTG0701	Annie Creek	736.1E	Timber Gulch (N. Fork)	1
			Total CDAs	11

3.9.3 Environmental Consequences for Hydrology and Soils

The proposed treatments for the West Rim project may affect the following four watershed components: aquatic ecosystems, soil productivity, geologic hazards and special areas. Aquatic ecosystems include physical conditions (sediment, bed/bank stability and flow regimes), chemical conditions (water quality) and biological conditions (aquatic life). Soil productivity includes soil erosion, soil compaction, nutrient removal, soil heating and regeneration hazard. Geologic hazards include mass failures. Special areas include riparian ecosystems, wetlands and floodplains.

Effects Common to All Action Alternatives

All action alternatives include a provision for sanitation harvest of mountain pine beetle infested trees. The effects of these actions would generally be expected to have similar effects to those described below for non-

commercial timber harvesting. However, because the sanitation harvest would occur on relatively few acres and it is expected that there would be full implementation of the Forest Plan Standards and Guidelines (FPS&G), which include WCPs and BMPs, the effects of the sanitation harvest on soils and hydrology would be expected to be minimal. No direct, indirect or additional cumulative effects from the sanitation harvest are expected.

Sediment

"*Most sediment delivered to streams comes from a source zone along streams whose width depends on topography, soils, and ground cover. Connected disturbed areas (CDA) like roads and other disturbed soil near streams can deliver sediment during runoff events. Sediment deposits in stream beds harm insect populations and fish reproduction.*," (USDA-Forest Service 1996a).

Watershed cumulative effects from sediment are an important concern in managed watersheds (Megahan and Hornbeck 2000). Sediments that reach the stream system can stay in the channel for years and create instream sediment sources that may have impacts at the site and downstream. Riparian vegetation provides a wide variety of benefits to stream systems, including providing shade to control stream temperature, root strength to maintain stream banks, and input of nutrients that form the base of many aquatic food webs (Bisson et al. 1987). Riparian areas can also serve as filters for increased sediment generated upslope. Stream buffers have been shown to be very effective in moderating cumulative watershed effects (Thomas et al. 1993).

Sediment yield changes following forest management in ponderosa pine has been studied in several locations. Experimental watersheds in Arizona show that sediment yield in managed ponderosa pine forests were low (Rich et al. 1961) and most sediments moved during larger storms and originated from the channels and the logging roads (Rich and Gottfried 1976). Other studies have shown basically no changes in total sediment production from the various treatments in ponderosa pine compared to the control (Baker et al. 1999). In a recent study comparing the effects of thinning and a wildfire on sediment production in the Colorado ponderosa pine forests, Libohova (2004) found that thinning treatments in ponderosa pine generated basically no sediment yield.

Roads are considered the primary contributors of sediments to streams in managed watersheds (Swanson et al. 1981, Amaranthus et al. 1985, Rice and Lewis 1986, Bilby et al. 1989, Donald et al. 1996, Megan and Kidd 1972, Reid and Dunne 1984, Rothacher 1971, Sullivan and Duncan 1981, and Swift 1988). Roads can also impact the ecological integrity of a watershed in many ways. Roads built on erodible soils and with an improperly planned road drainage network can impair the water quality in nearby streams (USDA-Forest Service 2001b). Under-sized culverts or bridges can wash out, contributing to erosion and sedimentation to levels that can be detrimental to other aquatic resources (USDA-Forest Service 2001b).

The focus of the sediment assessment is on full implementation of appropriate best management practices (BMPs) to result in no additional sedimentation or to limit sediment yields of the harvesting activities occurring within the Project Area. Increases in sediment yield by themselves do not constitute an adverse impact. However, when they adversely impact the beneficial uses of a stream they would be inconsistent with the Forest Plan.

The source zone of the streams is often referred to as the Watershed Influence Zone (WIZ). The Watershed Conservation Practices (WCP) Handbook (USDA-Forest Service 2006d) defines the WIZ as 100 feet minimum from each bank. Best Management Practices (BMP) (South Dakota State University 2003) defines it as a strip of at least 50 feet wide on each side of the stream. The width of the WIZ for the West Rim project is to follow the WCPH definition of 100 feet on either side of the stream or 200 feet total width. Field observations and experience indicate that if any sediment is produced from the WIZ it is generally produced in the first 25 feet from the stream (Gonyer 2007). Therefore, a 200-foot WIZ is considered to generally be an adequate distance for the northern Black Hills and the West Rim Project Area.

Alternative A (No Action) - Direct/Indirect Effects

Alternative A (No Action) would have no new activities associated with the West Rim Decision within the Project Area although existing approved projects are expected to be completed. Sediment delivered to the streams would be expected to generally remain at current levels and would not be expected to increase as the result of Forest Service activity. The risk of a wildfire within the Project Area would generally be expected to remain at current levels.

Alternative A (No Action) - Cumulative Effects

The spatial boundaries of the cumulative impact analysis are the HUC (Hydrologic Unit Code) 7 watershed boundaries and the time frame could span from 10 years past to 10 years into the future (1998-2018).

Sediment, at some level, is naturally occurring in the environment. The stream systems have adapted to and function at different levels and ranges. The introduction of sediment from human associated activity, if excessive, can impact the aquatic resource.

Past activities, usually road related, in the Project Area have likely contributed the largest amount of sediment to the streams. As shown on Table 36, there are 11 identified CDAs in the HUC 7 watersheds of the Project Area that are likely contributing sediment to streams. Existing road stream crossings are expected to remain unchanged in the Project Area.

There have been nine active timber sales in the area in recent years (Table 11). These sales cover an area of 5,114 acres within the West Rim Project Area. The effects of most of these sales are reflected in the existing watershed conditions analyzed above. The only sale that is currently active is the Hanna Timber Sale, which would affect 37 acres within the Project Area.

More recent timber harvesting and timber stand improvement projects within the Project Area have reduced the density of many of the stands. The area of past timber sales by watershed is presented in Table 37. These data show that the watersheds have had 20 percent or less of their areas managed recently. Annie and Cleopatra Creeks have had less than 10 percent managed recently and Lower Spearfish Creek contains no past timber sales.

Table 37. Cumulative Timber Sale Areas within the West Rim Project Area Watersheds.

Watershed (7th Level HUC)	Watershed Area (acres)	Past Timber Sale Area (% of watershed)	Alternative B and C Timber Sale Area (% of watershed)	Cumulative Timber Sale Area (% of watershed)
Annie Creek	8103	9%	29%	38%
Cleopatra Creek	9737	5%	14%	19%
Dead Ox Creek	6430	20%	40%	60%
Iron Creek	8310	10%	25%	35%
Lower Spearfish Creek	8565	0%	18%	18%
Middle Spearfish Creek	5238	11%	9%	20%
Upper Spearfish Creek	6756	19%	44%	63%
Totals	53139	10%	25%	35%

Cumulative impacts from sediment produced by the effects of high intensity wildfires would be expected if a large, intense wildfire burned in the Project Area. This alternative would be expected to have the highest number of acres classified at high fire risk of all the alternatives (JW Associates 2008b). High intensity fires can cause chain reactions of events that can impact watersheds. In general, high severity burn areas experience substantial duff reduction and loss in soil nutrients (Harvey et al. 1989) and soil heating (Hungerford et al. 1991). Water and sediment yields may increase as more of the forest floor is consumed (Robichaud and Waldrop 1994; Soto et al. 1994; and Wells et al. 1979). If fire consumes the duff and organic layers of the soil and the mineral soil is exposed, soil infiltration and water storage capacities of the soil are reduced (Robichaud 1996), which can result in increased erosion, runoff and sediment yield. Increased runoff from burned areas, combined with erosion, may result in substantial levels of sedimentation downstream (Moody and Martin 2001).

Alternative B (Proposed Action) - Direct/Indirect Effects

This alternative would treat more than 30 percent (13,000 acres) of Forest Service administered land within the Project Area with commercial timber harvesting. It is generally expected that minimal sediment would likely be generated from the commercial harvest activities through full implementation of the FPS&Gs, which include WCPs (design criteria) and BMPs, such as designating stream crossings and short lengths of skid trails within the WIZ. Although an increase in sediment from skidding at the designated stream crossings may occur, sediment yield would be minimized through the use of WCPs and BMPs. The timber harvesting activities would likely generate little sediment, if any, and would not likely increase sediment yield. This conclusion is supported by the results of the Soil Health Monitoring conducted in the Project Area, field observations, scientific literature and professional judgment.

New road construction of 35 miles would be accomplished to provide access to the harvest areas (Table 7). Some of these new roads would involve stream crossings (Table 38) that have the potential to become CDAs. Some of these streams already have CDAs due to stream crossings (Table 36), such as Annie Creek, Iron Creek and Spearfish Creek. The design of the new road crossings would be expected to fully implement FPS&G, which include WCPs design criteria and BMPs that would be expected to result in no additional CDAs.

Table 38. Road Stream Crossings Alternative Comparison

Stream	Watershed	Existing Road Stream Crossings	Alternatives B and C New Road Stream Crossings	Cumulative Road Stream Crossings
Annie Creek	Annie Creek	2	2	4
Timber Gulch (N. Fork)	Annie Creek	2	0	2
Cleopatra Creek (formerly Squaw Creek)	Cleopatra Creek	0	1	1
Eleven Hour Gulch	Cleopatra Creek	3	0	3
Deadhorse Gulch	Dead Ox Creek	2	0	2
Deer Creek	Iron Creek	5	0	5
Iron Creek	Iron Creek	8	2	10
Sawmill Gulch	Iron Creek	4	0	4
Robison Gulch	Lower Spearfish Creek	11	0	11
Ice Box Gulch	Middle Spearfish Creek	2	0	2
Jackass Gulch (N. Fork)	Middle Spearfish Creek	4	0	4
Spearfish Creek	Upper Spearfish Creek	12	1	13
Total Road Stream Crossings		55	6	61

However, in a Condition Class III watershed (Forest Plan Watershed 8503 - Lower Spearfish Creek), existing CDAs (Table 36) in streams that have new stream crossings would be required to be evaluated and redesigned such that they would no longer be CDAs. The direct effect of these actions would be to reduce the number of CDAs in the Project Area and for individual streams.

With the full implementation of the FPS&Gs, which include WCPs and BMPs, the amount of increased sediment from harvest activities would not be expected to result in impacts on water quality. Potential sediment yield to streams from this alternative would be less than Alternative A primarily due to the reduction of the CDAs. Timber harvest would have little to no effect, with a minor effect from road use compared to Alternative A.

Overall the impacts on sediment yield from this alternative would be a slight potential increase in sediment yield in the short term (less than five years) in some categories (harvesting, road use and road stream crossings)

and a potential decrease in sediment in the long term (greater than five years) in other categories (CDAs) in the Project Area.

Alternative B (Proposed Action) - Cumulative Effects

Cumulative effects include past management activities on NFS lands and activities on private lands. The past effects of management of federal lands have not created increased sediment yield, except for the CDAs that have been created by road stream crossings. Management of private lands has also created some localized impacts. The current sediment yield conditions are reflected in the existing condition discussion in this document. There would be only minor amounts of management activity occurring in the same time and space as Alternative B (Table 11). Therefore; the cumulative impacts would be very similar to the direct and indirect impacts discussed above. With the full implementation of the FPS&Gs, which include WCPs and BMPs, the amount of increased sediment from harvest activities would not be expected to result in a significant impact on water quality. The Category III watersheds (Cleopatra, Iron and Lower Spearfish Creeks) would have some of the lowest cumulative treatment areas in the Project Area (Table 37). There are two positive cumulative impacts, the reduction in CDAs and the reduction in high intensity wildfire risk.

The likelihood of more quickly suppressing a high intensity wildfire with the potential of containing it to a smaller acreage would be expected to be of greater likelihood compared to Alternative A. More than 10,000 acres of ponderosa pine stands would change from high or very high fire risk to low or moderate fire risk within the Project Area under this alternative. The hydrologic effects of intense wildfires are discussed under cumulative impacts of Alternative A. If a wildfire would occur in the Project Area, the risk of adverse effects and increased sediment yield from the more than 10,000 acres treated would be reduced. Therefore, Alternative B would generally be expected to have a lower risk of increased sediment yield from intense wildfires than Alternative A.

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

Alternative C - Direct/Indirect Effects

The direct and indirect effects of Alternative C would be very similar to Alternative B. Similar to Alternative B, it is generally expected that minimal sediment would likely be generated from the fire reduction treatments in Spearfish Canyon through full implementation of the FPS&Gs, which include WCPs (design criteria) and BMPs, such as designating stream crossings and short lengths of skid trails within the WIZ. They would also create an additional benefit of some reduction in fire risk close to Spearfish Creek, which could reduce the potential for sediment yield increases should a high intensity wildfire occur in this area.

With the full implementation of the FPS&Gs, which include WCPs and BMPs, the amount of increased sediment from harvest activities would not be expected to result in a significant impact on water quality. Potential sediment yield to streams from this alternative would be less than Alternative A primarily due to the reduction of the CDAs. Timber harvest would have little to no effect, with a minor effect from road use compared to Alternative A.

Overall the impacts on sediment yield from this alternative would be a slight potential increase in sediment yield in the short term (less than five years) in some categories (harvesting, road use and road stream crossings) and a potential decrease in sediment in the long term (greater than five years) in other categories (CDAs) in the Project Area with this alternative.

Alternative C - Cumulative Effects

The cumulative effects include past management activities and activities on private lands. The past effects of management of federal lands have been minimal, except for the CDAs that have been created by road stream crossings. Management of private lands has also created some localized impacts. The current sediment yield conditions are reflected in the existing condition discussion in this document. There would be only minor amounts of management activity occurring in the same time and space as Alternative C. Therefore, the cumulative impacts would be very similar to the direct and indirect impacts discussed above. There are two positive cumulative impacts: the reduction in CDAs and the reduction in intense wildfire risk.

The risk of extensive high intensity wildfire events is expected to generally be reduced with this alternative as compared to Alternative B. More than 10,000 acres of ponderosa pine stands are targeted to be changed from high or very high fire risk conditions to low or moderate fire risk conditions within the Project Area. The hydrologic effects of high severity wildfires are discussed under cumulative impacts of Alternative A. If a wildfire would occur in the Project Area, the risk of adverse effects and increased sediment yield from the more than 10,000 acres treated are expected to be lower as compared to Alternative A. Based on acres treated, Alternative C would have a lower risk of increased sediment yield from intense wildfires than Alternative A.

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

Bed and Bank Stability

"*Bed and bank stability can be damaged from trampling by animals or humans, vehicle impact, degraded bank vegetation, or excessive flow augmentations. Streams can be made wider and shallower, pools and overhanging banks can be destroyed, and much sediment can be added to streams*," (USDA-Forest Service 1996a).

Alternative A (No Action) - Direct/Indirect Effects

This alternative does not propose any new activities within the Project Area, so bed and bank stability would not be affected and would be expected to remain at the current condition.

Alternative A (No Action) - Cumulative Effects

Past activities in the Project Area that have contributed to bank instability are primarily from cattle grazing, as well as road and trail construction, and mining. Ongoing grazing occurs in 11 allotments: Higgins Gulch, Tollgate, Bear Ridge, Pettigrew, Ragged Top, Plateau, Buskala, Wildcat, Little Spearfish, Griffith, and Deadman. Grazing has been occurring for over 100 years within the West Rim Project Area and is expected to continue indefinitely. Grazing impacts on stream bank stability have been noted in stream health surveys that

were conducted for this project in Upper Spearfish Creek, Eleven Hour Gulch, and Dead Horse Gulch. However, changes in the management of grazing are not a part of this decision. Therefore, impacts on bed and bank stability would continue into the future and are not expected to change. There would be no additional cumulative impacts on bed and bank stability in the Project Area with this alternative because no new activity is proposed.

Alternatives B (Proposed Action) and C - Direct/Indirect Effects

Alternatives B and C include commercial and non-commercial vegetation management and associated road maintenance and construction activities. However, the proposed activities as part of these alternatives would not have an impact on bed and bank stability because project activities would not be allowed to damage stream beds and banks due to the restrictions in the WIZ. The only exception is new road crossings. The new road stream crossings would occupy only a very small area in those streams where they would be constructed. These new road stream crossings would follow FPS&G, which include WCPs and BMPs, and the design criteria, and would therefore have a minimal effect on streambed and bank stability.

Alternatives B (Proposed Action) and C - Cumulative Impacts

There would be no additional cumulative impacts on bed and bank stability in the Project Area with Alternatives B and C because the proposed activities would have a minimal impact on bed and bank stability.

Flow Regimes

"*Flow regimes can be altered by major changes in cover type or ground cover, dense road networks, or water projects. Water temperature and chemistry, sediment transport, aquatic habitats, and aquatic life cycles can be degraded.*" (USDA-Forest Service 1996a)

Increases in water yields from forest treatments have generally been regarded as a positive effect of forest management. Due to the limited amount of water available, many watershed studies have been conducted to determine how to increase water yield in ponderosa pine forests. MacDonald and Stednick (2003) conducted a recent literature review of water yield studies. That literature review found that water yield increases from timber harvesting are relatively short-lived, lasting on the order of 8-13 years. The magnitude of water yield increases tend to decline following treatments due to revegetation. Sheppard and Battaglia (2002) confirm the results of MacDonald and Stednick in the Black Hills and add that the level of treatment needed would be 20-25 percent of the forest to realize and sustain increased water yields. Based upon the research, thinning is not likely to remove enough trees to be effective at generating increased water yields. The amount of clearcuts proposed in this project is less than 200 acres and would not have any influence on water yield or peak flows.

Forest management activities have been extensively studied with regard to the effects of timber harvesting and road building on changes in peak flows. The consensus in the literature is that peak flow changes from timber harvesting generally occur during drier seasons (Harr 1979) where the amount of evapotranspiration exceeds available soil moisture. During the summer and fall, the trees are generally transpiring soil moisture that is not being recharged by rainfall. When the tree density, and consequently transpiration, is reduced, the soil moisture remains higher and there is a greater potential for runoff from summer or fall storms.

Road drainage systems may alter a stream's hydrograph. These changes occur when subsurface and surface flow is captured at road cuts and in ditches, and redirected into a channel (USDA-Forest Service 2001b). Roads can also direct water away from a stream (USDA-Forest Service 2001b). The effects of road drainage can include an increase in the peak discharge, changes in the shape and timing of the hydrograph, increases in the total discharge, and potentially a decrease in water quality (USDA-Forest Service 2001b). Roads that are in close proximity to streams and road-stream crossings may cause changes to a stream's streamflow, reduction in water quality, and sedimentation (USDA-Forest Service 2001b). However, flow regimes do not appear to be adversely affected by dense road networks in the Black Hills. Road density does not appear to increase peak flows in the Black Hills, based on field reviews (Gonyer 2007).

Increases in runoff and peak flow events following wildfire can be of concern where watershed features permit a higher probability of flooding and debris flows (Cannon and Reneau 2000). Increased runoff from burned areas, combined with erosion, may result in substantial sedimentation downstream (Moody and Martin 2001).

Alternative A (No Action) - Direct/Indirect Effects

Alternative A proposes no new activities within the Project Area, so flow regimes would not be affected. The risk of a wildfire within the Project Area would generally be expected to remain at current levels.

Alternative A (No Action) - Cumulative Effects

Past activities and fire suppression policies in the Project Area have influenced flow regimes. Fire suppression has reduced water available for streamflow through increased biomass and subsequent higher evapotranspiration. The existing flow regimes would continue under this alternative. The Project Area has a high risk for fire. Increases in runoff and peakflow events following wildfire can be of concern where watershed features permit a higher probability of flooding and debris flows (Cannon and Reneau 2000, Driscoll et al. 2004). If a large high intensity wildfire occurs in the future, flow regimes could be impacted from reduced infiltration rates. Alternative A would have no cumulative impacts on flow regimes unless a large high intensity wildfire occurs.

Alternative B (Proposed Action) - Direct/Indirect Effects

Alternative B includes commercial and non-commercial vegetation management (Table 6). These activities would reduce the biomass and could have some effect on the flow regime. Increases in water yields from forest treatments have generally been regarded as a positive effect of forest management. Many watershed studies have been conducted to determine changes in water yield from forest management. Usually 25 to 30 percent of the growing stock in a forested watershed must be removed before there is a measurable increase in water yield (Sheppard and Battaglia 2002). The 187 acres of clearcut harvest is likely the only treatment that would increase water yield or change flow regimes. Therefore, the treatments in Alternative B are unlikely to have any affect on flow regimes in the Project Area due to the small area of clearcuts.

New road construction of 35 miles would increase road density in all watersheds in the Project Area (Table 39). Roads can convert subsurface runoff to surface runoff and then route the surface runoff to stream channels, increasing peak flows (Megan and Kidd 1972, Ice 1985, Swanson et al. 1987). Flow regimes do not appear to be

adversely affected by dense road networks in the Black Hills (Gonyer 2007). Therefore road density is not a good predictor of peak flow increases due to management actions.

Table 39. Road Density Alternative Comparison

Watershed	Watershed Size (acres)	Existing Road Density (mi./sq.mi.)	Alternatives B and C New Roads (miles)	Alternatives B and C Road Density (mi./sq.mi.)	Change in Density (mi./sq.mi.)
Lower Spearfish Creek	8,565	3.0	2.4	3.2	0.2
Cleopatra Creek	9,737	2.8	6.4	3.2	0.4
Iron Creek	8,310	3.8	6.5	4.3	0.5
Annie Creek	8,103	3.4	5.5	3.8	0.4
Middle Spearfish Creek	5,238	3.4	1.2	3.6	0.1
Dead Ox Creek	6,430	3.9	6.8	4.6	0.7
Middle Spearfish Creek	6,756	4.0	4.8	4.4	0.5

The increased road density in the Condition Class III watersheds (Lower Spearfish Creek, Cleopatra Creek and Iron Creek) is a concern with regard to the Forest's direction for Condition Class III watersheds (see Watershed Condition Classes) that includes that "*the activities show overall improvement (e.g. decommissioning some of the existing road mileage)*." Roads in the Project Area are currently being evaluated in the Travel Management Planning process for the entire Black Hills National Forest. In order for these new roads to be constructed in Condition Class III watersheds, the Northern Hills Ranger District would need to recommend that road densities be kept at existing levels or reduced as part of the Travel Management Planning process to be consistent with Forest Plan direction.

Alternative B (Proposed Action) - Cumulative Effects

Past activities and fire suppression policies in the Project Area have influenced flow regimes. The cumulative effect of Alternative B on flow regimes would be similar to Alternative A. The only difference would be that while high intensity crown fires would still be expected to occur under either alternative, vegetative treatments implemented in Alternative B would generally be expected to lower the severity and extent of the effects associated with a wildfire event to the watersheds as compared to Alternative A.

Alternative C - Direct/Indirect Effects

Alternative C would generally be expected to have similar effects on flow regimes as Alternative B. The additional fuels treatments located within Spearfish Canyon would generally not be expected to change flow regimes because they would only remove some of the trees in those areas.

Alternative C - Cumulative Effects

Past activities and fire suppression policies in the Project Area have influenced flow regimes. The cumulative effects of Alternative C on flow regimes would be similar to Alternative A. The only difference would be that the risk of a high intensity wildfire would be less following implementation of Alternative C.

Temperature/Oxygen

"*Summer water temperature is increased, and winter water temperature is decreased, by removing shade, reducing low flows, or damaging banks so streams are wider and shallower. Dissolved oxygen is usually reduced when summer water temperature is increased. Such impacts impair or destroy the suitability of water bodies for aquatic biota,*" (USDA-Forest Service 1996a).

Alternative A (No Action) - Direct/Indirect Effects

Alternative A proposes no new activities within the Project Area, so water temperature and dissolved oxygen concentrations would not be affected.

Alternative A (No Action) - Cumulative Effects

Increased biomass in the Project Area has an impact on the upland areas; therefore stream shading has not been impacted, except in local areas on private lands. The 2006 State Water Quality Assessment (SDDENR 2006) does not show any streams not supporting their beneficial uses because of high stream temperatures.

Alternatives B (Proposed Action) and C - Direct/Indirect Effects

These alternatives include commercial and non-commercial vegetation management. The effects of the treatments on low flows are uncertain (see Flow Regime). Riparian vegetation that provides critical shade would be protected through BMPs. Therefore, there would be no direct or indirect impacts on water temperature and dissolved oxygen concentrations from these alternatives.

Alternatives B (Proposed Action) and C - Cumulative Impact

These alternatives would have no additional cumulative impacts to water temperature and dissolved oxygen concentrations within the Project Area because they would have no direct or indirect impacts.

Water Purity

"*Water purity can be degraded by placing concentrated pollutant sources near water bodies, applying harmful chemicals in or near water bodies, or intercepting hazardous rock strata by roads. Degrading water purity can impair or destroy use of the water by aquatic biota and humans,*" (USDA-Forest Service 1996a).

Alternative A (No Action) - Direct/Indirect Effects

Alternative A proposes no new activities within the Project Area, so water purity would not be affected.

Alternative A (No Action) - Cumulative Impact

There are no known concentrated pollutant sources in the Project Area from the past or expected in the future and no known harmful chemicals applications near water bodies in the past or expected in the future

within the Project Area. There would be no additional cumulative impacts to water purity in the Project Area with this alternative.

Alternatives B (Proposed Action) and C - Direct/Indirect Effects

These alternatives include commercial and non-commercial vegetation management. None of these activities involves placing concentrated pollutant sources near water bodies or applying harmful chemicals near water bodies. In the Forest Plan Management Requirements (FPMR) in Appendix A, Standard 1211 addresses this concern and requires vehicle service and fueling areas to be done on gentle upland sites.

Alternatives B (Proposed Action) and C - Cumulative Impacts

Activities in these alternatives would not result in additional cumulative impacts to water purity within the Project Area because there would not be any concentrated pollutant sources placed near water bodies, harmful chemicals applied in or near water bodies, or hazardous rock strata intercepted by roads.

Aquatic Life

"*Aquatic life can be degraded by migration barriers, changed flow regimes, riparian damage, or big sediment loads or chemical loads,*" (USDA-Forest Service 1996a).

Flow regimes are discussed under the flow regime section, sediment loads are discussed under the sediment section and chemical loads are discussed under water purity section of this report. Riparian damage is discussed under Special Areas below. Migration barriers are discussed in the Wildlife Resource Report (JW Associates 2008c). No impacts are expected to any of these areas affecting aquatic life. Therefore, all alternatives would have no direct, indirect or cumulative effects on aquatic life.

Soil Erosion and Compaction

"*Severe erosion can impair long-term soil productivity if soils are heavily disturbed on shallow or highly erodible soils. Evidence of severe erosion is rills or pedestals,*" (USDA-Forest Service 1996a).

"*Soil compaction is caused by excess weight of vehicles and animals. It impairs infiltration, root growth, and soil biota,*" (USDA-Forest Service 1996a).

Erosion is the movement of soil particles by raindrop impact or overland flow. Erosion from timber harvesting is generally only a problem in areas of intense disturbance. Most of the sediment and erosion that originate from forestry operations can be traced to roads and skid trails or log landings (Isaak et al. 2003, South Dakota State University 2003). Activities on soils with characteristics that increase their likelihood of becoming compacted when wet can change the pore space conditions of these soils, causing more runoff or resulting in poor plant growth.

The Forest has conducted soil bulk density sampling periodically since 1998 (USDA-Forest Service 2007e). Complete soil bulk density sampling and evaluation information through 2006 for the Black Hills National Forest is presented in the Black Hills National Forest FY2006 Monitoring and Evaluation Report (USDA-Forest Service 2007e). Various Black Hills soils can be compacted if heavy equipment use occurs when soils are wet or exceed the plastic limit. However, no increase was observed in bulk density results from pre-harvest

sampling to post-harvest sampling conducted in 1999 for the Hellsgate timber harvest unit, Northern Hills Ranger District (USDA-Forest Service 2007e). In order to prevent detrimental soil compaction and remain within Regional soil quality standards (USDA-Forest Service 1996a), the following design criteria from the Region 2 Watershed Conservation Practices Handbook (USDA-Forest Service 2006d) has been included in the action alternatives and would be implemented in association with project activities, including post-sale activities:

- Roads, landings, skid trails, and other concentrated use sites would be restricted to designated sites consistent with WCPH Management Measure 12/Design Criteria (a); and
- Heavy equipment use for land treatments would be operated only when soil moisture is below the plastic limit or soil is protected by packed snow or frozen soil consistent with WCPH Management Measure 13/ Design Criteria (b).

Alternative A (No Action) - Direct and Indirect Effects

Alternative A proposes no new activities on soils within the Project Area. Under the no action alternative, existing soil erosion concerns associated with skid trails, U-roads, and very steep slopes would persist. Pedestalled mature plants, rills, and gullies would continue to exist. Conditions may worsen without effective repair of roads with substandard drainage systems. Without new compaction caused by ground-based harvest equipment, soil productivity would likely improve over time and existing levels of bulk density could be expected to decrease over time in compacted soil areas through various natural processes, such as root development, freeze/thaw cycles, or wildlife activity (e.g. gopher excavation).

Alternative A (No Action) - Cumulative Effects

Fire risk in the Project Area is currently high and is expected to increase over time. High intensity wildfires can cause increased erosion depending on the severity of the conditions as a result of the fire, location on the landscape, extent, steepness of the slope, etc. In general, high severity burn areas experience significant duff reduction, loss in soil nutrients (Harvey et al. 1989), and soil heating (Hungerford et al. 1991). Water and sediment yields may increase as more of the forest floor is consumed (Robichaud and Waldrop 1994, Soto et al. 1994, and Wells et al. 1979). If fire consumes the duff and organic layers of the soil and the mineral soil is exposed—soil infiltration and water storage capacities of the soil are reduced (Robichaud 1996), which can result in increased erosion, runoff and sediment yield. Dramatic increases in erosion and sediment yield can be caused by intense wildfires followed by rainfall events.

The cumulative effects of past management activities are displayed in the existing conditions of soils as documented in the soil survey reports. There would be no cumulative impacts on soil erosion in the Project Area with Alternative A because no new activities would occur.

Alternative B (Proposed Action) - Direct and Indirect Effects

Alternative B includes commercial and non-commercial timber harvest to modify stand structure and reduce stand density, and prescribed fire to reduce the amount of available ground fuels and to mimic natural disturbances. Harvest methods would include ground based and cable logging systems, depending on terrain. 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 and displacement. Soil erosion can occur when rainstorms occur on sites where the ground cover has been removed and the infiltration rate of soils has been reduced due to compaction. Different logging and harvesting methods would be utilized to minimize soil displacement, compaction and ground cover reduction.

Past harvesting areas showed some signs of erosion and compaction mostly associated with roads (see Alternative A discussion in this section above), however those areas were limited. Harvesting activities that fully implement FPS&Gs, Region 2 WCPH design criteria and BMPs would generally be expected to have similar effects due to the examination of past timber harvesting effects and the slight off-road erosion potential for soils in the Project Area. Land treatments and associated soil disturbance in Alternative B would be managed to limit the sum of severely burned and detrimentally compacted, eroded, and displaced land to no more than 15 percent of any land unit. Activities in previously harvested units would use existing skid trails and landings, as much as possible, in order to not exceed the 15 percent detrimental disturbance standard for each unit.

Approximately 35 miles of new road construction and 126 miles of reconstruction would be required to implement Alternative B. Road reconstruction would potentially reduce the risk of erosion and mass wasting since existing 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. No roads are proposed for decommissioning; the necessity of existing roads is being determined by the ongoing development of the Forest-wide Travel Management Plan. Likewise, no changes are proposed to off-road motorized vehicle regulations under the West Rim project.

Most of the proposed new roads (25.7 miles) would cross soils rated as moderate on-road erosion potential. These areas would adhere to Forest Plan standards as impacts can be mitigated with design criteria. Where possible, new roads would be re-routed to avoid sensitive areas, minimizing the overall erosion potential. Where re-routing the roads is not feasible, design criteria are in place to minimize the effects to soil resources. All new roads constructed for the West Rim project would be closed following harvest activities. Design criteria would be applied to each road segment to reduce erosion and to avoid sensitive areas.

Alternative B (Proposed Action) - Cumulative Effects

Fire risk in the Project Area is currently high and would be expected to be reduced as a result of the treatments proposed in Alternative B. As discussed in Alternative A, high intensity wildfires can cause increased erosion. The risk of increased erosion as a result of wildfires would be reduced compared to Alternative A. Activities in previously harvested units would use existing skid trails and landings, as much as possible, in order to not exceed the 15 percent detrimental disturbance standard for each unit. Implementation of Forest-wide direction, on objectives, standards, and guidelines related to management activities would generally be expected to conserve or improve soil conditions in the Project Area and cumulative effects would be expected to be similar to the existing conditions.

Alternative C - Direct and Indirect Effects

Alternative C would include all the activities described under Alternative B above. In addition, this alternative adds adaptive management fuel reduction buffers around all structures in the Project Area and some additional areas in Spearfish Canyon. Timber harvest and fuel reduction treatments would be expected to have effects similar to those described in Alternative B.

Treatments would not be conducted on slopes over 30 percent in Spearfish Canyon (Appendix B). No new roads or trails would be constructed on NFS land and mechanical equipment (chippers, ATVs, vehicles) would be restricted to paved/gravel surfaces or frozen ground in Spearfish Canyon. These measures would be expected to keep ground disturbance and associated erosion and soil compaction within limits identified in Regional soil quality standards (USDA-Forest Service 1996a) and Region 2 Watershed Conservation Practices Handbook (USDA-Forest Service 2006d).

Alternative C - Cumulative Effects

As with Alternative B, the proposed stand thinning and fuels treatments in Alternative C would be expected to reduce the risk of high intensity wildfire and the adverse effects to soil erosion often associated with such events. Activities in previously harvested units would use existing skid trails and landings, as much as possible, in order to not exceed the 15 percent detrimental disturbance standard for each unit. Implementation of Forest-wide direction, on objectives, standards, and guidelines related to management activities would generally be expected to conserve or improve soil conditions in the Project Area and cumulative effects would be expected to be similar to the existing conditions.

Soil Heating

Alternative A (No Action) - Direct and Indirect Effects

Under Alternative A, severe soil heating effects, such as complete consumption of ground cover vegetation, litter, and duff, development of water repellency, extensive soil erosion, decreased soil biological activity, and disturbance of the soil nitrogen pool, could occur more extensively in the event of a stand-replacing fire. These and other altered conditions of soils may affect long-term productivity of sites (USDA-Forest Service 2005c).

Alternative A (No Action) - Cumulative Effects

Cumulative effects from a potential wildfire may be expected to be greatest under Alternative A due to the highest fire risk.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Prescribed burning is expected have no effect on erosion, productivity, and landslide risk in the West Rim Project Area. Prescribed burns on soils identified as having a high potential for fire damage potential would take place only when burn severity could be kept low. Furthermore, prescribed burns on slopes over 30 percent would be conducted when soil, duff, and large fuels are sufficiently moist to retain beneficial duff as ground cover for prevention of erosion. Burning activities may create areas of bare mineral soil, vegetation removal, and soil heating. Ground cover vegetation in these areas generally recovers within a year or two. Some wildfire areas within the Black Hills have been documented to recover protective vegetation within about 3

years (Driscoll et. al. 2004). Burning retains some nutrients on site, and thereby contributes to conserving 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 are expected to reduce the risk or extent of high intensity wildfire events, and the adverse effects to soil often associated with such an event.

The direct and indirect effects of Alternatives B and C from soil heating caused by prescribed fires would be expected to be within soil quality standards. Burns would be conducted in accordance with WCPH Management Measure 13, Design Criteria (c) to limit the amount of time that fire heats the soil surface. This measure would be expected to generally prevent soil heating to the point that soil could become severely burned as defined in USFS 2006b. The soil health assessments conducted in the Project Area did not find areas of adverse soils impacts from prescribed fires. The proposed prescribed burning in the Project Area would be expected to have beneficial long-term effects by limiting the extent or intensity of future crown fires that may occur within the Project Area, thereby limiting soil heating that might be associated with high-intensity wildfires.

Alternatives B (Proposed Action) and C - Cumulative Effects

There may be some additional prescribed burning that would occur on private lands within the Project Area. However, the extent of those burns would be very small in comparison to the acres burned on NFS lands. No prescribed burns have been conducted on NFS land (other than pile burning) within the past 10 years and wildfires that have occurred in the area in the past 10 years have been small (often less than one acre). Therefore, the cumulative effects of prescribed fire on soil heating would be the same as the direct and indirect effects.

Nutrient Loss

Alternative A (No Action) - Direct and Indirect Effects

Under the no action alternative, nutrient removal caused by harvesting would not occur and nutrient levels may increase over time. Soil nutrients could be severely impacted in the event of a high intensity fire. In general, high severity burn areas experience significant duff reduction, loss in soil nutrients (Harvey et al. 1989), and soil heating (Hungerford et al. 1991).

Alternative A (No Action) - Cumulative Effects

Cumulative effects on soil nutrients from a potential wildfire would be expected to be greatest under Alternative A due to the highest fire risk.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Loss of soil nutrients is a potential indirect effect of timber harvest activities, since the majority of soil nutrients are concentrated in the foliage, branches, and the root system of trees. The total acres proposed to be treated by commercial treatments are 13,379 acres for Alternatives B and C. Overstory and understory vegetation as well as slash and other down woody material would be retained in treated areas, with the

expectation that soil nutrient levels would generally be maintained or potentially improved, as well as aiding the conservation of site moisture. All the surveyed soils have the potential of soil organic matter content at less than two percent. Those soils would require that following design criteria be implemented to comply with Forest Plan Standard 1102:

- Conventional harvest systems that retain the slash would be used within the specified soil map units; or
- If whole tree harvesting is used, fine slash (less than three inches in diameter) would be returned to the site if quantities identified in Forest Plan Standard 1102/Guideline (a) are not met.

Alternatives B (Proposed Action) and C - Cumulative Effects

There may be some harvesting that would occur on private lands within the Project Area that has the potential of removing nutrients from those sites. However, the extent of harvest areas would be small and it is likely that slash would be retained on site. Proposed harvesting under Alternatives B and C would not occur on areas that have been harvested in the past 10 years. Therefore, the cumulative effects of soil nutrient loss would be similar to the direct and indirect effects.

Mass Movement

Alternative A (No Action) - Direct and Indirect Effects

Under Alternative A, no new activities are planned on slopes with characteristics indicative of mass movement potential. Soil mass movement may be expected to continue at existing levels or may increase if a high-intensity fire occurs and results in extensive tree mortality on these soils.

Alternative A (No Action) - Cumulative Effects

There may be some additional new roads constructed on private lands but those plans are not known at this time. Therefore, the cumulative effects on mass movement would be expected to be the same as the direct and indirect effects.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Forest Plan Standard 1108 states that on-site slope-stability exams are to be conducted (1) on slopes over 30 percent prior to design of roads or activities that remove most or all of the timber canopy on certain soil types (e.g. Lakoa, Larkson, and Citadel soils in the Bear Lodge Mountains; Rockoa and Mathias soils on the Dakota Hogback; and Citadel soil found in the northern and eastern Black Hills), and (2) on slopes over 55 percent prior to the design of roads or activities that remove most or all of the timber canopy on all other soil types (USDA-Forest Service 1996a). There is only one area of slightly more than 3 acres that is a concern for timber canopy removal (clearcut) on Citadel soils. The new roads would attempt to avoid very steep slopes and would comply with Forest Plan Standard 1108.

The application of Forest Plan Standard 1108 would minimize the potential for mass movement events. Mass movements would generally be expected to be limited to rates similar to those that are expected for the geology that exists within the Project Area.

Alternatives B (Proposed Action) and C - Cumulative Effects

Activities on private lands and other activities that could influence the likelihood of soil mass movement in the Project Area would also generally be expected to incorporate similar design criteria. The small area (three acres) that is a concern for mass movement has not been harvested in the last 10 years. The application of Forest Plan Standard 1108 would minimize the potential for mass movement events. Mass movements would generally be expected to be limited to rates similar to those that are expected for the geology that exists within the Project Area. Therefore, adverse cumulative effects are not expected.

Riparian Ecosystems

"*Riparian ecosystems provide shade, bank stability, fish cover, and woody debris to aquatic ecosystems. They also provide key wildlife habitat, migration corridors, sediment storage and release, and surface-ground water interactions. Composition and structure of riparian vegetation can be changed by actions that remove certain species age classes,*" (USDA-Forest Service 1996a).

Alternative A (No Action) - Direct and Indirect Effects

Alternative A would have no new activities within the Project Area so there would be no direct or indirect impact on riparian ecosystems.

Alternative A (No Action) - Cumulative Effects

Activities in the past that have affected the riparian ecosystems include grazing and roads. Cattle activities that can affect riparian areas include grazing in riparian areas and passing through them looking for water. These impacts include trampling the area or damaging the stream bank because the area is wet. Grazing the vegetation can change the species composition of the area. Road crossings in riparian ecosystems have a direct effect by eliminating these areas at the crossing. There would be no additional cumulative impacts to riparian ecosystems within the Project Area with this alternative because no new activities are planned.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Alternatives B and C include commercial and non-commercial vegetation management (Tables 6 and 8). However, there would be no commercial activities within riparian areas. The WIZ area of 100 feet on each side of the stream would also protect riparian areas by allowing only beneficial treatments inside the WIZ. There would be some direct impacts to riparian areas by new road crossings. There would be six new road stream crossings (Table 38). These road crossings would destroy the riparian area in the immediate area of the new road. These six road crossings would comprise a very small area compared to the riparian areas of these streams. The direct and indirect effects of Alternatives B and C would result in minimal impacts to riparian areas from the new road crossings.

Alternatives B (Proposed Action) and C - Cumulative Effects

There are currently 55 road stream crossings (Table 38). Those combined with the 6 new road stream crossings would total 61 (Table 38). That would result in a cumulative increase of about 11 percent; however all the CDAs (Table 36) are road stream crossings and the total number of CDAs would be lower as a result of redesign of

existing CDAs. Therefore, there would be only minor additional cumulative impacts to riparian ecosystems within the Project Area from the new road crossings.

Wetlands

"*Wetlands control runoff and water quality, recharge ground water, and provide special habitats. Actions that may alter their ground cover, soil structure, water budgets, drainage patterns, and long-term plant composition can impair these values,*" (USDA-Forest Service 1996a).

Alternative A (No Action) - Direct and Indirect Effects

Alternative A would have no new activities within the Project Area so there would be no new impacts on wetlands.

Alternative A (No Action) - Cumulative Effects

Activities in the past that have affected the wetlands include grazing and roads. Cattle can affect wetlands by trampling the area and creating a hummocky landscape because the area is wet. Roads crossing linear wetlands (along streams) have had a direct impact by eliminating these areas. There would be no additional cumulative impacts to wetlands within the Project Area with this alternative because no new activities are planned.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Alternatives B and C have the potential to affect wetlands that are associated with streams in the areas of the proposed new road crossings. The road crossings would be required to avoid impacting wetlands or the Forest Service would be required to obtain a Section 404 permit from the US Army Corps of Engineers before proceeding. Approval of a Section 404 permit would require mitigation. Therefore, avoidance or mitigation would result in no impacts as a result of the proposed projects.

Alternatives B (Proposed Action) and C - Cumulative Effects

There would be no additional cumulative impacts to wetlands within the Project Area.

Floodplains

"*Floodplains are natural escape areas for floods that temper flood stages and velocities,*" (USDA-Forest Service 1996a).

Alternative A (No Action) - Direct and Indirect Effects

Alternative A would have no new activities within the Project Area so there would be no impact on floodplains.

Alternative A (No Action) - Cumulative Effects

Activities in the past that have affected floodplains are primarily roads and are usually associated with stream crossings. Road fills at stream crossings can have an impact on floodplains if the crossings are not designed appropriately. Adequately designed culverts allow floodwaters to pass without increasing the flooded area above the culvert. Generally, some increased flooding upstream of road fills does not cause problems as it usually affects a small area and there are usually no improvements in the floodplain. There would be no

additional cumulative impacts to floodplains within the Project Area with this alternative because no new activities would occur.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

Alternatives B and C propose six new road stream crossings. The floodplains are not currently mapped in these areas. However, the crossings would be designed to accommodate flood flows so that impacts to floodplains would be minimal if any.

Alternatives B (Proposed Action) and C - Cumulative Effects

There are currently 55 road stream crossings (Table 38) that all fall in the floodplain. Those combined with the 6 new road stream crossings would total 61 (Table 38). That would result in a cumulative increase of about 11 percent; however all the CDAs (Table 36) are road stream crossings and the total number of CDAs would be lower as a result of redesign of existing CDAs. Therefore, there would be only minor additional cumulative impacts to floodplains within the Project Area from the new road crossings.

3.10 Transportation

3.10.1 Existing Conditions for Transportation

The existing transportation system was inventoried and reviewed in 2007. Currently, approximately 213 miles of road exists on NFS land. An estimated 200 additional miles of road are located on private land. Timber that would be accessed within the proposed sale areas would utilize existing transportation facilities where possible. Some additional system roads may be added through new construction and conversion of existing unclassified roads. Existing roads may require improvements including blading surface irregularities, establishing or re-establishing drainage structures, clearing vegetation or hardening the road surface. This work would be accomplished by reconstruction or pre-use maintenance to accommodate the logging traffic.

The West Rim area is currently considered open for travel except for areas with yearlong closures (wildlife and surface) and seasonal closures to protect wildlife and to prevent road damage. At present there are a number of road closures located throughout the area. The Travel Management Plan for the Forest is currently under revision. That planning may result in changes to the existing road miles and densities and to the allowable on and off-road activities in the Project Area.

The Forest Service does not have right-of-ways for some private roads. If one of the action alternatives is selected and not all right-of-ways are acquired, some units may need to be dropped.

3.10.2 Transportation System Summary by Alternative

Improvements that can be done only under reconstruction include installing drainage structures, clearing and grubbing, and adding aggregate to harden the roadbed or drainage structures. Realignment of the road may also be done only under reconstruction. For the West Rim project, it is estimated that less than one percent of the total reconstruction miles would be realignment.

Changing road conditions make it difficult to predict how much work would be needed at the time of timber harvest. Since both pre-use maintenance and reconstruction would likely involve disturbance of the surface, for the purposes of analysis, there is no differentiation between reconstruction and pre-use maintenance in order to allow unforeseen problems to be corrected. The final determination of the amount of road work that is needed would be made based on input from the District specialists and by a route verification at the time the timber sale road package is put together.

Typically, unclassified/unnecessary roads are identified for decommissioning as part of a forest health project, such as West Rim. However, due to the ongoing development of a forest-wide Travel Management Plan, all decisions on the necessity of unclassified roads have been deferred to that process to avoid conflict between the West Rim and Travel Management decisions.

3.10.3 Environmental Consequences for Transportation

Alternative A (No Action) – Direct, Indirect and Cumulative Effects

Alternative A would have no direct effect on the present condition because no additional roads would be constructed or reconstructed within the Project Area as a result of this project. Existing roads that have BMP violations would be addressed during specified maintenance as funding becomes available; road maintenance would continue under the no action alternative. Because no new roads would be constructed and road maintenance would still occur, no cumulative effects are expected.

Alternatives B (Proposed Action) and C – Direct and Indirect Effects

Access to the proposed treatment areas would require approximately 35 miles of road construction and 125 miles of reconstruction or pre-use maintenance, which would potentially have the following direct and indirect effects:

- Improvement and maintenance of the existing roads would provide better vehicle access to the area.
- The addition of new system road miles would likely increase maintenance costs and increase road density. However, all newly constructed roads would be closed yearlong following harvest activities. The method of closure would be determined by the various specialists and the District Ranger.
- A temporary increase in soil erosion may be caused by removal of roadway vegetation. However, these roads would be reseeded following disturbance and sediment basins may be constructed to catch run-off.
- The addition of aggregate surfacing or placing rock in rolling dips would decrease erosion.

Additional measures to minimize impacts would be implemented using "Engineering Design Guidelines" and "Best Management Practices." Past haul analysis for this area used to compare haul alternatives to mill locations have indicated the point of appraisal to be Spearfish, South Dakota.

Alternatives B (Proposed Action) and C – Cumulative Effects

The cumulative effects analysis area is the road network within the West Rim Project Area. The time period considered extends as far back as road construction has occurred and into the foreseeable future.

The West Rim Project Area currently contains 213 miles of roads on NFS lands. Alternatives B and C, if fully implemented, would result in an additional 35 miles of road construction, for a total of 248 miles on NFS lands, a 16% increase. In addition, approximately 125 miles, or 59%, of the existing road network would be reconstructed or receive some form of pre-use maintenance under this project. These activities would improve road conditions and lessen the potential detrimental effects (e.g., sedimentation, CDAs, erosion) that roads may have on the landscape. For analysis of the impacts of the proposed road activities on individual resources, refer to the appropriate section within this document.

3.11 Lands/Minerals/Special Uses

3.11.1 Existing Conditions for Lands

The existing complicated land ownership pattern in this area was set in motion, in part, by the Euro-American settlement that came to the area partially as a result of the Custer expedition of 1874. This settlement started as a gold rush and quickly evolved to include cattle grazing, agriculture and logging. Associated with this were roads and trails to provide access to markets.

Lands that now constitute the Black Hills National Forest were entrusted to the federal government for management as a result of the Organic Administration Act of 1897, which established many Forest Reserves in the west. Lands have been removed from the Federal domain and put into private ownership as mining claims and homesteads. The earliest patent was issued for a mining claim in 1903 and the last for homestead in 1916.

Since the passage of the Small Tracts Act in 1983, the Forest has been active in "squaring up" its boundary through land conveyances to private individuals under the provisions of this act.

A number of private and public road easements have been granted in the Project Area for private access across National Forest System (NFS) lands and vice versa. The project file contains information related to these easements.

3.11.2 Existing Conditions for Special Uses

Recreation Residences

One special use cabin is located within the Project Area boundary. The Cearnal cabin is located three miles South of Savoy (T4N R2E Section 10). This cabin is a privately owned structure located on NFS land. Earlier in Forest Service history people were encouraged to build recreation cabins on NFS land. This is no longer the practice, but existing cabins are allowed to remain under special use permits.

Other Special Use Permits

On Terry Peak, there are nine special use permits issued on NFS land for communication purposes. Present are various towers and communication devices for radio, television, telephone and two-way communications. Communication towers are also located on private property on Terry Peak.

The South Dakota National Guard holds its annual training on the Forest during the second week of June. One site they use within the West Rim Project Area is located on Terry Peak. Proposed treatments for this area under the action alternatives include prescribed fire and small tree removal. Coordination between USFS and SDNG would ensure that the training activities and any proposed activities under the action alternatives are compatible.

There are numerous utility line permits for the Project Area. Most notable are the electrical transmission lines (230 KV) belonging to Black Hills Power. In both Alternatives B and C there are proposed management activities around the power lines. These lines should be shown as protected improvements on the timber sale maps. Timber harvest activities associated with the action alternatives might provide an opportunity to remove hazard trees from the powerline corridors. Timber removal activities could include timber within the powerline right of way for line maintenance.

A number of electrical distribution lines and telephone lines exist within the West Rim area. These lines are smaller in nature but should also be shown on the timber sale maps as protected improvements.

Four special use permits for waterlines exist within the Project Area. All four permits are in Spearfish Canyon, and no treatments are proposed in the vicinity of any of the waterlines.

3.11.3 Existing Conditions for Minerals

The West Rim Planning Area is primarily composed of Lower Permian age sandstone, limestone, and shale. Small areas of Eocene and Paleocene quartz also occupy parts of the Project Area. It is these quartz areas that have shown to be mineral-producing, the principle product being gold.

Mining played a large part in the development of this area, as evidenced by numerous historic prospect pits, adits, shafts, and abandoned mine workings. Minerals can be divided into three categories on NFS lands: locatable, leaseable, and saleable. 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 minerals, but no public gravel pits or other active sources of saleable minerals exist in the Project Area. Locatable minerals are those such as gold, copper, silver and other metals, which 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.

There are numerous unpatented placer and unpatented lode claims in the Project Area. None of the claimants have surface rights; therefore, management activities and access within these claim boundaries generally are not a concern. The placer claims along creeks are used primarily for recreational hand panning and sluicing. An ongoing, approved placer mine operates in the northern portion of the Project Area (Section 24, T4N, R2E). Current activity on this claim includes claim boundary marking; no ground disturbance has begun. Three exploratory drill sites will be operating within the northwestern portion of the Project Area. Abandoned opened portals and small open pits are scattered across the Project Area. Communication with claimants on working claims is imperative during all phases of the project. There are numerous inactive claims.

Ongoing clean up of the Annie Creek Superfund site is within the project boundary however it is located on private land. This site was created by arsenic and low level cyanide contamination from past mining activities on private land. However, the effects of the Superfund site extend onto National Forest System lands. The 1994 Final Response Action Work Plan states:

- Minimize land-disturbing activities, wherever possible now and in the future;
- Disturbance to the Annie Creek floodplain corridor shall be minimal.
- EPA required reclamation of the area by covering some of the site with clean soil and rock. These areas should not be disturbed with earth moving equipment. The site continues to be monitored through a ground water monitoring program by South Dakota Department of Environment and Natural Resources (SD-DENR).

3.11.4 Environmental Consequences for Lands/Minerals/Special Uses

The area considered for the cumulative effects analysis is the NFS lands within the West Rim Project Area boundary. The timeframe considered extends from Euro-American settlement (the beginning of land/mineral usage of the area) into the foreseeable future.

Lands/Special Uses - Direct, Indirect and Cumulative Effects

Alternatives A, B, and C would have no affect on the lands or special use programs currently in operation. All alternatives would continue existing easements and special use permits. Alternative A would not require the acquisition of any new rights-of-way. Alternatives B and C would both require the acquisition of fourteen rights-of-way.

Alternative C proposes structure buffer treatments for fire hazard improvement within the immediate and surrounding vicinities of the recreation residence cabin. Removal of some trees and ground fuels would reduce the fire danger in the vicinity of the cabin. There should be no direct impacts to the cabin lot itself, but the surrounding landscape would be altered by management practices. There would also be a short term increase in traffic on the road to the cabin during treatment. In the long term, treatments proposed under Alternative C would be beneficial to the recreation residence because of the reduced fire hazard.

Management activities proposed under either alternative would have no effect on the Terry Peak Communication Site, as improvements would be protected during implementation.

Mitigation for Lands/Special Uses

- Protect all documented NFS lands boundary corners, posts and bearing trees.
- Avoid and/or protect utility infrastructure in Project Area during project implementation.
- To mitigate the effects immediately adjacent to the recreation residence cabin, the special uses staff would assist in marking trees and notifying permit holders of management activities.

Minerals - Direct, Indirect and Cumulative Effects

BLM index to mining claims LR 2000 lists numerous claims within the Project Area. While not active, there is always the possibility that they may become so during the life of the project. This could affect travel management as the owners of these claims need access to their area of operation. Two active claims exist in the Project Area and communication with claimants on these working claims is imperative during all phases of the project.

Because none of these claims are currently experiencing mining activity and because the activities proposed under the West Rim alternatives would not affect access to them, no direct, indirect or cumulative effects are expected.

3.12 Travel and Recreation Use

3.12.1 Background

Spearfish, South Dakota, is immediately north of the Project Area and several smaller communities such as Savoy and Elmore sit within the Project Area boundary. Spearfish Canyon transects the Project Area from north to south. This Project Area has a high recreation value on the Northern Hills Ranger District especially for day use and dispersed types of recreation. The transportation system is well developed with both paved and high standard gravel roads providing easy access for the public visiting the Forest.

The overall busiest season is between July and September. Three seasonal peaks occur on an annual basis. The first peak occurs during the second week of August during the Sturgis motorcycle rally when approximately 500,000 visitors are present in the Black Hills. Riding motorcycles in Spearfish Canyon is very popular and several thousand riders could be present at any given time during that week. The second peak occurs around the third week of September when many visitors are driving Spearfish Canyon, Highway 85 and Forest System Road (FSR) 134 viewing the fall colors. The third peak of recreationists occurs in November during big game hunting season, when a large number of hunters are dispersed throughout the Project Area.

Other types of recreation that are popular in the Project Area include day hikes, bicycling, cross country skiing, picnicking, rock climbing, snowmobiling and driving for pleasure including cars, four wheel drive vehicles, all terrain vehicles (ATV) and dirt bikes.

The Recreation Opportunity Spectrum (ROS) from the Forest Plan for the five Management Areas (MAs) in the Project Area are shown on Table 40.

Table 40. Recreation Opportunity Spectrum (ROS) Designations by Management Area

Management Area	ROS Designation
4.1	Roaded Natural Non-motorized
4.2A	Roaded Natural
5.1	Roaded Natural
5.4	Roaded Natural
5.6	Roaded Natural

Roaded Natural Non-motorized means the area is closed to motorized use, yet has been heavily modified or is not large enough to set aside as semi-primitive non-motorized.

Roaded Natural means the area is characterized by predominantly natural appearing environments with moderate evidence of 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 construction standards and design of facilities.

3.12.2 Existing Conditions for Travel and Recreation Use

Developed Recreation

Campgrounds

There is one developed campground within the Project Area at Iron Creek Lake, which lies entirely on private land. This small lake is a high use area between Memorial Day and Labor Day. Although the campground and lake are on private land, they are entirely surrounded by National Forest System (NFS) land and there is a lot of associated use on the forest. FSR 134 is the primary access to the lake and FSRs 222.1 and 222.3 are the secondary roads visitors use to access the lake. Many visitors stay at the Iron Creek Lake Campground and go on day hikes or ATV rides into the forest from there.

Three developed Forest Service campgrounds are adjacent to but not within the Project Area boundary. Hanna, Rod and Gun, and Timon campgrounds have thirteen, seven and seven camping units respectively. All three campgrounds are currently under special use permit to a concessionaire who does all the administration and care between Memorial Day and Labor Day. These campgrounds receive moderate use with peaks during the holidays.

Picnic Grounds

The Forest Service operates four developed picnic grounds within Spearfish Canyon: Botany Bay, Long Valley, Hellsgate and Dead Ox. These picnic grounds were originally developed and operated by Homestake Mining

Company. The Forest Service obtained these facilities during a land exchange with Homestake in 1992. Each of these picnic areas has from one to three tables and an outhouse. These facilities are in need of updates, which are being analyzed in the Forest-wide Recreation Facility Analysis. They will not be addressed as part of the West Rim project. Use of the picnic areas varies by season with higher use occurring during the Sturgis Rally and fall leaf viewing season. During the winter, the level of use is very low. Botany Bay picnic ground also receives use from the local youth, who like to use it as a party site.

Hiking Trails

There are six hiking trail systems that are partially or completely within the boundaries of the West Rim Project Area: Big Hill, Old Baldy, Rimrock, '76, Roughlock Falls and Eagle Cliff.

The Big Hill trailhead is just outside the West Rim boundary but the entire trail system lies within the Project Area. This trail system is approximately 15 miles long with four different loops and one overlook. This trail system receives moderate use throughout the year from hikers, bikers, horseback riders and cross country skiers. This trail system is groomed for cross country skiing during the winter by a volunteer group. This trail system is used for various recreation events such as mountain bike races, volksmarches, ski races and lessons, and orienteering. The majority of the trails within the Big Hill system are logging roads that have been converted to trails. As management needs dictate, these trails are used as roads for logging and other management purposes.

The Old Baldy trailhead and approximately one mile of the trail system is within the project boundary. This trail receives moderate use during the summer and fall months from hikers and bikers and, occasionally, horseback riders. The majority of the trails within the Old Baldy system are also logging roads that have been converted to trails. As management needs dictate, these trails are used as roads for logging and other management purposes.

Approximately one quarter mile of the Rimrock trail system is within the boundary of the Project Area. The remainder of the trail system and trailhead are south of the boundary. This trail experiences moderate use during the summer and fall months by hikers and bikers.

The '76 trailhead is located at the community of Savoy and is one mile long. This steep historic trail climbs up the side of Spearfish Canyon and offers a spectacular view of the Canyon. It receives moderate to high use during the summer and fall from visitors staying at Spearfish Canyon Lodge.

The Roughlock Falls trailhead is also located at Savoy. This trail is just outside the project boundary. It is one mile long and follows Little Spearfish Creek to Roughlock Falls. The picnic facilities and parking lot are operated by the State of South Dakota while the hiking trail is maintained by the Forest Service. This easy trail also receives high to moderate hiking use in the summer from visitors staying at Spearfish Canyon Lodge.

The Eagle Cliff trail system has 25 miles of trails with multiple loops and two official trailheads within the project boundary. There are also four other access points to the Eagle Cliff system that are regularly used by the public. This trail system is used moderately throughout the year by hikers, bikers, horseback riders and cross country skiers. This trail system is groomed in the winter for cross country skiing by a volunteer group. The majority of the trails within the Eagle Cliff System are logging roads or skid trails that have been

converted to trails. As management needs dictate, these trails are used as roads for logging and other management purposes.

Dispersed Recreation

Camping and Picnicking

Occasionally, members of the public will camp or picnic in dispersed areas throughout the Project Area, but this is not very common. Open fires are not allowed in the Black Hills so many visitors choose to camp at a developed site so they can have a campfire.

Trails

The Tinton trail is a 50 mile long non-system trail that is maintained by a user group. Approximately 13.5 miles of this trail is within the West Rim project boundary. This trail is used under the special use permit process for two mountain bike races and a foot race. This trail is also occasionally used by hikers. This trail is not marked on the ground except during events and there are no official trailheads. There is high use during events and light use during other times.

There are approximately seven miles of snowmobile trail within the project boundary. Big Hill trailhead and Savoy are both used as snowmobile trailheads. Barricades are placed on the roads that are part of the snowmobile trail system starting on December 1 each year to allow a base of snow to build up. The snowmobile trails are groomed from December 15 to March 31 each year. A special order is in effect each year from December 15 to April 1 prohibiting wheeled traffic on the snowmobile trails. Snowmobile trails are a combination of system and unclassified roads. The State of South Dakota and the Forest Service are partners in the snowmobile program. The Forest Service provides the land base for the program and the state grooms, signs and provides law enforcement for the trail system.

There are several areas that are popular for hiking that are not part of the trail system including Devil's Bathtub and Iron Creek from Spearfish Canyon.

There are 11 known rock climbing areas in Spearfish Canyon. These are user created and maintained areas with bolts and pins present in the rock formations. Occasionally the rock climbing community will install new routes. It is possible that other rock climbing areas exist in the Canyon that the Forest Service is not aware of.

Driving for pleasure whether by car, four wheel drive, ATV or dirt bike is a very popular form of recreation. The Black Hills National Forest is currently analyzing travel management under another NEPA planning effort; therefore the West Rim project would defer this analysis to the Forest-Wide effort.

Other forms of dispersed recreation include hunting for elk, deer, turkeys or mountain lions, which occurs just about any place throughout the Project Area.

Special Use Permits

There are three outfitter and guide permits to lead big game hunting, one to lead bicycle tours, two to lead guided hiking and six for recreation events. Hunting can take place anywhere on NFS lands within the project

boundary. The permitted recreation events, hiking and biking tours occur on the existing Big Hill, Old Baldy, and '76 system trails and the non-system Tinton trail.

3.12.3 Environmental Consequences for Travel and Recreation Use

The geographic area considered for cumulative effects analysis includes the NFS lands within the West Rim Project Area. The timeframe considered extends from ten years past through ten years into the future (1998-2018).

Alternative A (No Action) - Direct, Indirect and Cumulative Effects

This alternative assumes no implementation of any elements of the proposed action or other action alternatives. The no action alternative represents no attempt to actively respond to the purpose of and need for action or the issues raised during scoping for this project. Under the no action alternative no effort to modify existing vegetation or related fuels and habitat conditions in the Project Area would occur. None of the actions associated with this EIS would occur. Actions such as ongoing Forest protection efforts and recurring road maintenance on system roads would continue as directed by the Forest Plan. Actions proposed by other forest health projects may still occur. Under the no action alternative, no direct, indirect or cumulative effects would occur as a result of the West Rim project.

Alternatives B (Proposed Action) and C - Direct and Indirect Effects

The effects to recreation can be mitigated though design criteria and are the same for both action alternatives. None of the developed recreation sites or dispersed recreation opportunities would be significantly altered by management activities proposed under the West Rim project. All proposed activities are consistent with the MAs and their associated ROS classes.

Developed Recreation

The recreating public in the Northern Hills Ranger District of the Black Hills is accustomed to seeing vegetative management activities including logging or fuels reduction in or near the recreation sites. The Big Hill, Old Baldy and Eagle Cliff trail systems were all originally logging routes that were converted to trails. On occasion these trails are again used for vegetative management by the Forest Service. Opportunities or desirability of recreation may be impacted in the short term while management activities are occurring, but recreationists are likely to return to areas once treatment is completed.

A potential indirect effect of the activities proposed under West Rim is the temporary closure of recreation sites for safety reasons. Another indirect effect would be an alteration of the visual landscape as a result of timber harvest. Timber harvest is common in the Black Hills and, as mentioned, recreationists in the area are accustomed to active forest management.

Dispersed Recreation

The dispersed activities of hunting, hiking and driving for pleasure would adjust to the management activities and the visitors could choose to go to another location to recreate.

As with developed recreation, activities would be impacted short term and a potential indirect effect would be unavailability of certain areas during management activities. Dispersed recreationists are more able to find other places to recreate (i.e., their activities aren't typically tied to one particular recreation site), which would lessen the effect to them. Another indirect effect would be an alteration of the visual landscape as a result of timber harvest.

Alternatives B (Proposed Action) and C - Cumulative Effects

Developed Recreation

One potential cumulative effect exists in the area of the Big Hill trail system. Management activities (prescribed burning specifically) authorized under the Griggs Fuel Management Categorical Exclusion (CE) are ongoing in this area. The West Rim action alternatives would result in timber harvest and additional prescribed fire in this area. Recreationists who favor the Big Hill area would see increased levels of forest management over the next 5 to 10 years.

Several timber sales have occurred in the Project Area. Only one of these (Hanna) is still open, but post-sale (KV) activities are ongoing at many of the others. None of the West Rim harvest units would overlap previous timber sales, but established snowmobiling, hiking and cross country trails may traverse areas managed under West Rim and previous projects. Recreationists would see evidence of past treatment and active forest management under West Rim while traveling on some trails.

Fuel reduction activities have taken place and are ongoing in Spearfish Canyon under the Spearfish Canyon 1 and 2 Categorical Exclusions (CEs). Both Alternatives B and C would treat additional areas of Spearfish Canyon in the same fashion as the Spearfish Canyon 1 and 2 CEs. These treatments are intended to reduce the risk of fire near homes and involve the hand cutting, piling and burning of small diameter (less than 9 inch diameter at breast height) trees and surface fuels. These CE projects and the proposed fuel treatments under West Rim have little to no effect on the visuals within the Canyon that draw sightseers so no negative cumulative effect is expected.

Dispersed Recreation

Dispersed recreationists may be more likely to experience cumulative effects because they conceivably utilize more of the Project Area than those recreationists who use developed sites. Other than the Griggs Fuel Management area described above, there is not expected to be a direct overlap of West Rim management actions with past or reasonably foreseeable future actions, but dispersed recreationists may see the effects of past management and active management under West Rim as they move across the Project Area.

3.13 Scenery

3.13.1 Introduction

The Black Hills National Forest included the Scenery Management System as the basis for analyzing the scenery resource. This scenery assessment tool has illustrated the features of the landscape that can be

inventoried and analyzed so managers can compare and evaluate vegetation management treatments based on an understanding of how people value their environment. This management system is used to assess the impacts of this proposed project and alternatives.

The current Black Hills Forest Plan and Landscape Aesthetics, A Handbook for Scenery Management, number 701 was used to determine the existing inventory of visual conditions (landscape character), variety classes, scenic class values, scenic attractiveness, landscape sensitivity levels (landscape visibility), scenic integrity objectives (SIO) per Forest Plan, and existing scenic integrity for the West Rim Project. This system was used to assess the impacts of the proposed project and alternatives on the existing scenic character and values of the Project Area. Where needed, mitigation measures to ensure the SIOs of the Forest Plan are met would be identified. All National Forest System (NFS) lands will be analyzed using this system.

3.13.2 Existing Conditions for Scenery

Visual resources consist of landforms, vegetation, rock and water features and cultural modifications that create the visual character and sensitivity of landscapes. Important visual resources are areas that have landscape qualities of unusual or intrinsic scenic value and areas of human and cultural use that are valued for their visual settings.

The project impact area for visual resources includes the proposed action and alternatives, major and secondary access roads, staging areas for proposed activities, adjacent recreational use areas, and surrounding viewsheds where the appearance of the proposed activities may alter landscape quality and sensitive views. Viewing locations within foreground (within 0.5 mile) and middleground (0.5 to 4.0 mile) distances have been assessed for representative residential, highway and roadway, and recreational land use.

The Project Area contains approximately 213 miles of roads on NFS land and approximately 200 miles of roads on private land. Additionally, there are approximately 45 miles of designated non-motorized trails including trails in the Eagle Cliff, Big Hill and Old Baldy systems, and approximately seven miles of designated snowmobile trails. The Project Area provides four designated picnic grounds: Botany Bay, Long Valley, Dead Ox and Hellsgate.

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.

The description of this area and landscape character are found in the following documents:

- Ecological Land Unit – Laccolith Mountains (1996 Forest Plan FEIS, Appendix B, pg. 46)

- Existing Land Use Patterns – Natural Appearing and Developed Transitional (Alternative C) (1996 Forest Plan FEIS, Appendix B, pg. 48)
- Valued Landscape Character Unit (LCU) Overview (1996 Forest Plan FEIS, Appendix B, pg. 49)
- Mountainous Mixed Forest Landscape Character Unit – Laccolith Mountains Portion. (1996 Forest Plan FEIS, Appendix B, pg. 50-51)

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 the scenery with the value of other resources such as timber, wildlife, or old-growth. The components of scenic class are Scenic Attractiveness and Landscape Visibility (USDA - Forest Service 1995).

The higher the scenic class, the more important it is to maintain the highest scenic value. The scenic classes on the Black Hills National Forest are 1 (highest), 2, 3, and 4 (lowest). The scenic classes demonstrate the importance of the views in different areas. Table 41 shows the Scenic Classes within the West Rim Project Area. The Class 1 Scenic Class values are predominately located within Spearfish Canyon. Private land represents 9.4 percent of the Project Area and is not classified for scenic class.

Table 41. Scenic Classes for the West Rim Project Area.

Scenic Class	Area (acres)	Percent of Project Area
Class 1	7,618	18.0%
Class 2	20,174	47.6%
Class 3	7,931	18.7%
Class 4	2,678	6.3%

Scenic Attractiveness

Scenic attractiveness is defined as the overall visual impression or attractiveness of an area, considering the variety, vividness, coherence, harmony or pattern of landscape features. Scenic attractiveness is defined according to three levels in the EIS:

- A - Distinctive, resources that are unique, outstanding or exemplary in quality;
- B - Typical, resources that are typical of the physiographic region and commonly encountered: common scenic quality; and
- C - Indistinctive, those landscape or cultural areas that either lack visual resource amenities or have been degraded.

Scenic attractiveness demonstrates different degrees of variety within the landscape. The scenic attractiveness within the West Rim Project Area shows a large percentage of A – Distinctive compared to surrounding landscapes (Table 42). The A – Distinctive values are predominately located within Management Area (MA) 4.2-A, (Spearfish Canyon), along travel ways, and in MA 5.6 (areas managed for Recreation, Big Game and Forest Products). Land uses such as recreational activities are typically planned and located in areas with "Distinctive" scenic attractiveness characteristics.

Table 42. Scenic Attractiveness for the West Rim Project Area.

Scenic Attractiveness	Area (acres)	Percent of Project Area
A - Distinctive	14,426	33.7%
B - Typical	16,386	38.3%
C - Indistinctive	10,896	25.5%

Landscape Visibility (Sensitivity)

Landscape visibility (Sensitivity) is defined as a measure of an area's potential sensitivity to visual change. Visual sensitivity considers viewer types and volumes, as well as viewing distance zones. Areas and associated viewer types considered to be potentially sensitive to visual changes include: designated park and recreation areas, major travel routes, and residential areas. Landscape visibility is important for its scenic quality, aesthetic values, and landscape merits. Sensitivity Level 1 travelways attract a higher percentage of users having high concern for scenic quality, thus increasing the importance of those travelways. Two distance zones are used for potentially sensitive view areas, foreground (within 0.5 miles) and middleground (within 0.5 to 4 miles).

Sensitivity Level 1 travelways outside the Project Area include Interstate 90 and within the Project Area includes US Highways 14A and 85. Approximately 20 percent of the NFS lands within the Project Area are viewed from Sensitivity Level 1 corridors where people have the highest concern for scenery (Table 43). In addition, the Project Area is immediately south of the community of Spearfish, South Dakota, which is the most populated area in the vicinity.

Table 43. Approximate Percentages of Land Viewed from Roadways within the Project Area by Sensitivity Level.

Sensitivity Level Class	Percent of Project Area
Sensitivity Level 1	20%
Sensitivity Level 2	57%
Sensitivity Level 3	22%

Sensitive viewer groups within the Project Area consist of rural residents and travelers along federal and state highways, as well as major and secondary routes through the forest. Residences occur in Spearfish Canyon along US 85 and 14A. Some residences are located in more remote areas on private parcels within the forest and along NFS primary and secondary routes. Dispersed recreational uses occur throughout the forest area.

Land Uses With Potential Views of the Project Area

Residential Areas and Communities

Residential areas, communities and subdivisions within the foreground, middleground, and background viewing distance zones of the project include: Spearfish, Savoy, Mountain Plains II, and Aspen Hills subdivision.

Major Travel Routes

Major travel routes in the Project Area include: US Highways 85 and 14A, and numerous NFS roads. Interstate 90 is outside the Project Area, however, portions of the Project Area can be viewed from Interstate 90.

Recreation Areas

The entirety of the West Rim Project Area has some form of dispersed recreational use, however the greatest recreational uses of sight seeing, driving for pleasure, fishing, bicycling, hiking, picnicking, hunting, and other dispersed uses occur during the summer and fall within Spearfish Canyon and at Iron Creek Lake. Winter activities including cross country skiing and snowmobiling occur within the Project Area near Eagle Cliffs, Old Baldy, and Big Hill areas. Snowmobile Trails 1 and 3 traverse through the Project Area as well as a small portion of Trail 2 in the extreme southern portion of the Project Area.

Scenic Integrity Objectives (Visual Quality)

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". These landscape values can be natural or natural appearing as well as humanly altered if the positive landscape character attributes have become accepted over time. 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 1995).

- **Very High** - Refers to landscapes where the valued landscape character is "unaltered" and intact with only minute deviations.
- **High** - Refers to landscapes where 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.
- **Moderate** - Landscapes where the valued landscape character "appears slightly altered". Noticeable deviations must remain visually subordinate to the landscape character being viewed.
- **Low** - 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 19 percent (10,163 acres) of the West Rim Project Area has a High SIO, predominantly in MA 4.2A (Spearfish Canyon) and some in MA 5.6 (Forest Products/Recreation/Big Game). Most of the High SIO is along the two highways (14A and 85) through the Project Area. Moderate SIO accounts for 37 percent (19,781 acres) of the Project Area, and Low SIO 24 percent (12,965 acres). The remaining land (10,231 acres) in the Project Area is in private ownership and not rated for 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 Project Area encompasses portions of the forest that provide dispersed recreation, both motorized and non-motorized, resource production, and big game winter range (Table 44). Spearfish Canyon provides both private and public uses throughout the canyon and represents the primary travelway and recreation area within the West Rim project boundary.

The elevation of the Project Area ranges from approximately 3,800 feet at the mouth of Spearfish Canyon to 6,969 feet atop Terry Peak. Steep slopes are prevalent in Spearfish Canyon. Rolling hills, plateaus and scattered mountain peaks typify the remainder of the Project Area. Ponderosa pine is the dominant forest vegetation, but areas of hardwoods and upland meadows are interspersed across the Project Area. The Project Area is noted for a mixture of hardwoods and conifers spread across a landscape of ridges and drainages and generally rolling terrain with small meadows and exposed rock formations. Vegetation alterations are scattered throughout the area. Water features are limited to narrow, quiet, low-flow streams; Iron Creek and Spearfish

Creek, and a private lake (Iron Creek Lake). Human alterations in the form of roads, homes, and mining activities appear in several diverse locations within the Project Area. Commercial activity and residential uses are confined primarily within Spearfish Canyon where private property is interspersed with NFS land, although some private residences are located in more remote areas within the project boundary. Most private land is located to the east of Spearfish Canyon or near Iron Creek Lake. Main roads through the area have generally been accepted over time as part of the positive cultural landscape character attributes. The combinations 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.

Table 44. Existing Scenic Integrity Objectives for the Project Area.

Scenic Integrity Objectives (SIO)	Area (acres)	Percent of Project Area
High	10,163	19.1%
Moderate	19,781	37.2%
Low	12,964	24.4%
Other	10,231	19.3%

This ponderosa pine forest has been managed with some timber harvesting; however, due to fire suppression, the forest remains denser than what existed before natural disturbance regimes were altered. Formerly there was a larger hardwood component, and the Forest Plan specifies hardwood enhancement as one of the Plan objectives. The Forest Plan directs an increase in treatments to encourage hardwood cover. The forest regenerates quickly; tree planting typically does not occur except under special conditions.

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 Project Area is viewed from major highways and private land from outside the Project Area (middleground and background), the Project Area maintains a natural appearance.

3.13.3 Environmental Consequences for Scenery

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 West Rim Project Area, including:

- Identify and describe the landscape character;
- Describe the scenic class, scenic attractiveness, and landscape visibility of the area;
- Compare the existing scenic integrity with the Forest Plan Scenic Integrity Objectives assigned to this area;
- Evaluate, measure, and quantify 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 SIOs are met.

Effects Common to All Action Alternatives

Commercial Vegetative Treatments

Commercial treatment prescriptions result in the removal of overstory trees within a stand. Non-commercial hardwood enhancement and pre-commercial thinning treatments do not remove the overstory. Many types of treatments are proposed for the West Rim project. These include commercial thinning from to 40 to 80 square feet of basal area (BA), overstory removal, seed cut, clear cut, meadow enhancement, commercial and non-commercial hardwood enhancement, pre-commercial thinning, as well as combinations of these treatments with prescribed burning.

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 than would be achieved without those measures.

Commercial treatment prescriptions result in the removal of overstory trees (9 inch and greater dbh) within a stand. The following is a description of the scenic changes associated with each of these treatments.

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 and 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 BA of 50 or more generally meet a Moderate to High SIO. Those with a residual BA between 30 and 50 generally meet a Low to Moderate SIO, and those with a residual BA 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 and seed cut removals result in an open area with seedlings covering the majority of it and 2-4 large (greater than 9 in. dbh) trees per acre (possibly fewer for seed cut). Commercial seed cut would retain the best formed and most dominant ponderosa pine. 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 percent, 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. Seed cut removal generally would meet a Low to Very Low SIO considering fewer trees would remain and the size of the opening could exceed typical natural opening size depending on the treatment area.

Commercial clear cut would essentially remove all trees of all sizes to establish a structural stage 1 (Grass/Forb). The area would likely not conform to a natural opening unless meadows are a part of the surrounding landscape. From a foreground, middleground, and background perspective the SIO would be Low to Very Low depending upon the surrounding forest stands. Clear cutting is a dramatic change in the character of the forest. The forest changes abruptly from a mature stand to a very young one. Logging debris is clearly evident. Mitigation is essential for clear cut blocks and these blocks should be small in size. Where this treatment is evident from any travelway, cut blocks should be designed with curved rather than straight edges. Islands of mature vegetation should be left to provide hiding cover for wildlife and vertical structure and diversity in the future stand. These design elements would insure the highest possible SIO for the clear cut area. Evidence of vegetation management would be evident during any season.

Pre-commercial Vegetative Treatments

Pre-commercial treatment prescriptions result in the removal of understory trees (less than 9 in. 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

In some cases where a unit is in close proximity to a travelway, whole tree yarding may be the preferable treatment method since it would reduce the amount of slash in the unit; however, it would increase slash at the landing site. 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 would 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 the 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 is easily able to move around it, consequently drying it out more quickly. The 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.

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.

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.

Transportation

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.

Roads in the West Rim 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.

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. It is not anticipated that road construction would have an effect on the Scenery Resource because they are in areas with low visual sensitivity.

Alternative A (No Action) - Direct and Indirect Effects

No direct effects would occur to the scenery resource under Alternative A because no management actions are proposed.

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 the 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 one to three 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. Prior to the trees being downed, large areas of insect infested trees would leave the visual scenery with red needled trees for the short-term until the trees fell. The long term effect of insect activity would ultimately leave a forest of skeletal trees that are susceptible to fire, but less catastrophic as compared to red needled trees. The skeletal trees would remain for many years until they are either blown down or fall of their own accord. The forest would slowly regenerate, but would maintain a park-like or open space condition until the understory has adequate time to mature into a young forest. The color, texture and ambiance of a mature forest would be dramatically altered for the long term with large areas of insect infested trees.

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 out-competing 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.

Alternative A (No Action) - Cumulative Effects

The cumulative effects to the scenery resource under Alternative A could see an increase in dead trees due to insect activity and the potential for wildfire due to red-needled or dead trees. Mountain pine beetles would continue to spread throughout the forest eventually leaving large stands of red-needled and dead trees. The scenery could be dramatically affected by the results of insect activity, leaving open park areas where forests previously stood. The scenic landscape would change from a natural appearing, diverse, interesting, and varied visual condition with color, form and texture to one of less visually appealing uniformity.

Alternative B (Proposed Action) - Direct and Indirect Effects

This alternative treats approximately 33 percent (17,363 acres) of the Project Area, of which 3,984 acres are in hardwood or meadow restoration, prescribed fire, and non-commercial and pre-commercial treatments. Approximately 13,379 acres are in commercial treatments.

Proposed vegetative treatments which are most likely to affect scenic quality within the Project Area include clear cuts, seed cuts, and overstory removal. The majority of these treatments that typically have the highest visual impacts are located outside the areas designated with High SIO for Alternative B. However, there are a few treatment areas located within travel corridors which do have high SIO or would potentially affect the visual integrity of private residences, views from travelways and recreation areas. These areas are described in detail in the West Rim Project Scenery Resource Report (JW Associates 2008g). Treatment units and specific mitigation recommended for these units are also found in the West Rim Project Scenery Resource Report (JW Associates 2008g).

The northern half of the Project Area would have the majority of hardwood enhancement treatments, both commercial and non-commercial. The area proposed for hardwood enhancement treatment totals 1,034 acres. These treatments would have a landscape effect by improving the quantity and quality of the hardwood clones. This would result in 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, and 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. For the West Rim project only 37 acres would have meadow enhancement treatment.

Alternative B treats 13,833 acres with prescribed fire across the Project Area. The prescribed burns would be throughout the Project Area and would be visible from many vantage points on both private and public lands. The prescribed burns would be similar to a natural underburn. Burning would be conducted to minimize damage to overstory trees. Given the moderate grade of the terrain, less torching or scorching of trees is expected to occur. An overall natural appearance would still be maintained after burning and the existing SIOs for the Project Area would still be met.

The other treatments within the Project Area would all meet their assigned SIO. The mix of treatments would create a variety of vegetation sizes and spacing within the natural range of vegetative patterns. These treatments would also reduce the potential for destructive (large-tree killing) wildfires and insect attacks due to the thinning of dense tree stands.

There are also some areas of sanitation harvest in mountain pine beetle infested ponderosa pine proposed under Alternative B. These areas have not been identified and therefore the scenic impacts cannot be related to a specific sensitivity area. However, if appropriate design criteria and mitigation are applied then the impacts would be short-term. There would be some positive aspects to the sanitation harvest because the trees that would be removed would die and turn red causing an adverse scenic impact for some viewers. Specific areas of sanitation harvest would be reviewed by a scenery specialist prior to implementation.

Indirect effects include 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.

Alternative B (Proposed Action) - 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 past activities in the field and determine their effect on scenery.
- Review planned activities in the field and determine the potential cumulative effects.

The physical boundary for analyzing cumulative effects is the Project Area 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 it is not known if that effort included any or all the West Rim 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 treats approximately 33 percent (17,363 acres) of the Project Area, of which 3,984 acres are in hardwood or meadow restoration, prescribed fire, and non-commercial and pre-commercial treatments, and the remaining 77 percent (13,379 acres) in commercial treatments.

Of the commercial treatments in this alternative, the overstory removal, seed cut, and clear cut treatments would result in a more open condition on approximately 5,976 acres, or 34 percent of the total treatment acreage. These treatments represent 11 percent of the total West Rim Project Area. Due to the rolling nature of this topography, most of these treatments would not be easily visible from Sensitivity Level 1 or 2 roads outside the Project Area except in the areas described in direct and indirect effects above. Panoramic views are evident in certain locations within the Project Area, particularly on the rim of Spearfish Canyon. The 76 trail terminates at the rim of the canyon and views from this location would be impacted by the proposed project, which includes seed cut and overstory removal treatments. 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 Project Area. Information on the existing open condition of the area is not available. However, with approximately 11 percent of the area in an open condition from the West Rim project, this is well within the Forest Plan goals for structural stages 1, 2, and 3A (20 percent) for Management Areas 4.1, 5.1, 5.4, and 5.6 (USDA - Forest Service 2006a).

The West Rim Project Area is used for sight seeing, hiking, biking, trail riding, hunting, ATV riding, camping, firewood cutting, cross country skiing and snowmobiling by the recreating public. The level of concern for a natural appearing landscape would likely continue at the same level.

The scenic effects of the past management are either not evident because of the time that has passed or are present at a very low level in the Project Area. The past, present and reasonably foreseeable activities in combination with the activities proposed under Alternative B would not result in additional effects compared to the direct and indirect effects of Alternative B. Therefore, the cumulative effects of Alternative B would be essentially the same as the direct and indirect effects. No additional cumulative effects would be noticeable other than the effects related to the proposed project.

Alternative C - Direct and Indirect Effects

Alternative C treats approximately 34 percent (18,291 acres) of the Project Area, of which 3,984 acres are in hardwood or meadow restoration, prescribed fire, and non-commercial and pre-commercial treatments. Approximately 13,379 acres are in commercial treatments and 928 acres are in Wildland Urban Interface (WUI) fuel reduction treatment buffer zones.

The effects of the commercial treatments are similar to Alternative B, with an additional 928 acres, primarily within Spearfish Canyon, being treated as WUI management fuel reduction buffers around all structures in the Project Area. This alternative was developed in response to scoping comments which raised the significant issue of further reducing fire hazard in Spearfish Canyon.

Spearfish Canyon is treated as a high SIO sensitivity level throughout the canyon. Although Spearfish Canyon is not a national scenic highway (due to lack of local support), it is a South Dakota state and local scenic highway. The Canyon is the most highly visited area in the Northern Hills Ranger District by recreationists and tourists (Keegan 2007). Activities include biking, sightseeing, picnicking, hiking, fishing, and other dispersed activities.

The Canyon is a high sensitivity area from a visual standpoint. The scenic ratings within the Canyon have high scenic visual values (Scenic Class - 1, Sensitivity Level – 1, Scenic Attractiveness –A-Distinctive, and existing scenic integrity – High). Spearfish Canyon is the most sensitive of all areas in the Black Hills National Forest. Effects of treatment should not be evident within one year of treatment in these high sensitivity areas (Keegan 2007).

Existing vegetative conditions in the Canyon include hardwoods along the Canyon floor and riparian areas. Hardwoods are the preferred species (per Forest Plan) for this management area. Long Valley picnic area has birch and aspen along the river. South of Savoy, diversity of species exists and the Forest Service would like to thin spruce in this area to enhance hardwoods. There is less recreation south of Savoy because the road does not have a shoulder. There are, however, more residences along this section of Spearfish Creek. US 85 is an important scenic travelway. The views of the foreground along the highway are important due to the high sensitivity level.

The method of treatment would be fuel reduction treatments on NFS land up to 300 feet from a private structure. Conifers that are greater than 9 inches dbh may be limbed up to 15 feet from the ground. Conifers less than 9 inch dbh may be removed. Cut material may be piled and burned, preferably on private land or removed for commercial sale with a permit. Hazard trees greater than 9 inch dbh may be removed with Forest Service approval. Follow-up treatments to maintain the buffers would be allowed under established time constraints. In addition, some stand structure would be altered to reduce the threat of mountain pine beetle infestation.

There are also some areas of sanitation harvest in mountain pine beetle infested ponderosa pine proposed under Alternative C. These areas have not been identified and therefore the scenic impacts cannot be related to a specific sensitivity area. However, if appropriate design criteria and mitigation are applied then the impacts would be short-term. There would be some positive aspects to the sanitation harvest because the trees

that would be removed would die and turn red causing an adverse scenic impact for some viewers. Specific areas of sanitation harvest would be reviewed by a scenery specialist prior to implementation.

These treatments may have a short-term impact on the visual corridor of Spearfish Canyon while treatment is occurring. The visual impacts would be noticeable in the foreground, middleground, and sometimes background depending upon the location of the structure to the highway. If adequate mitigation measures are implemented during treatment activity and after completion of treatments, the scenic impacts should be minimal, although the landscape characteristics would change from a more dense forest to a more open forest. Once treatment has been completed, the long-term visual landscape would likely be improved with more visibility into the forest and subsequent hardwood enhancement within the riparian corridor. It is possible that a better opportunity to view wildlife along the travelway and riparian area would be created with the more open viewing. It is anticipated that the existing scenic classifications would be maintained throughout the treatment area.

Alternative C - Cumulative Effects

This alternative treats approximately 34 percent (18,291 acres) of the Project Area, of which 3,984 acres are in hardwood or meadow restoration, and non-commercial and pre-commercial treatments. Over 10,841 acres would have post-treatment and broadcast burning. Approximately 13,379 acres are in commercial treatments and 928 acres are in Wildland Urban Interface (WUI) fuel reduction treatment buffer zones.

Cumulative effects would be similar to Alternative B with the addition of WUI fuel reduction buffers.

Alternative C results in an additional 928 acres being treated in a high visual sensitivity area. The increase in hardwood enhancement from fuel reduction treatments within Spearfish Canyon should improve the fall color and visual diversity within the canyon. Otherwise, the effects of Alternative C would be similar to Alternative B.

3.14 Heritage Resources

3.14.1 Background

Heritage resources are any district, site, building, structure, landscape, context, object, or conceptual content considered important to a culture, subculture, or community for scientific, traditional, religious, or other purposes. The potential for adverse effects to significant heritage resources is considered for each proposed undertaking. Significant heritage resources are either listed on or eligible for listing on the National Register of Historic Places (NRHP) and labeled as "historic properties". Indian tribes or other groups identify significant traditional cultural properties (TCP's) that also may be eligible for or listed on the National Register.

Heritage resources are managed for the following reasons: to prevent loss or damage until they can be evaluated for significance, to be retained for appropriate uses, to provide opportunities for scientific study about past human behavior and environments, or to provide interpretive opportunities to offer the public a better understanding of its collective human heritage (USDA-Forest Service 1996a p. III-115).

The distribution of heritage resources across the landscape leaves many clues about the activity and culture of peoples in the past and today. American Indians chose the most opportune camp sites, harvested local native plants and animals, utilized rock quarries to manufacture stone tools, and left their stories inscribed in the face of rocks. Today American Indians continue to make traditional use of natural and significant areas in the Black Hills.

The historic period brought change with the advent of industrial exploitation and settlement. This is apparent in the large numbers of mineral exploration, mining, milling and logging related archaeological sites that are found. Homesteads and farmsteads flourished and transportation systems expanded to rail lines and improved road systems. Archaeological remnants of these developments and subsequent structures that were constructed during the Civilian Conservation Corps period (1933-1942) still exist in this area.

Level I and III heritage resource inventories were conducted for the purpose of land management treatment inside the perimeter of the West Rim Project Area. These cultural resource inventories are the Archaeological Investigations of the West Rim Project Area (Smith, 2005), and Level III Cultural Resource Inventory of the West Rim Project Area (Kinsman, 2007).

The entire Project Area including land administered by the BHNF and private land was examined in the Level I reviews for documented heritage resources. Previous heritage resource inventory coverage amounted to 14,328 acres for report R2005020300204 and 45,951 acres for report R2005020300230. There were 10,055 acres not previously covered by adequate heritage resource inventories for report R2005020300204. Report R2005020300230 required 7,188 acres of new survey. A total of 18,207 acres were investigated for this project and reported in Project Reports R2005020300204 & R2005020300230.

Resource Protection Measures

The Black Hills National Forest manages and protects heritage resources on public land for the purpose of public interpretation, cultural importance to Native American Indians or other cultural groups, and for scientific research. Under Section 106 of the National Historic Preservation Act (NHPA), heritage properties are evaluated for their significance or "eligibility" for nomination to the National Register of Historic Places. Potential effects to sites evaluated as eligible, potentially eligible, and Traditional Cultural Properties must be considered. Protection or mitigation treatments are used to avoid or reduce adverse affects.

A standard measure for the protection of heritage resources is intensive field inventory and site identification prior to the implementation of land management projects. Mitigation or protection measures such as site avoidance, capping or plating site surfaces, and reducing or avoiding adverse effects are possible through consultation with the State Historic Preservation Office, the advisory council on Historic Preservation, interested Native American Tribes, and other applicable interested parties. Effects to sites can also be reduced or eliminated through archaeological recordation, structure recordation, interpretation, increased monitoring, and restrictive covenants.

3.14.2 Existing Conditions for Heritage Resources

The West Rim 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.

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.

A review of the level III report for West Rim (Kinsman 2007) indicates that there are 51 cultural resource properties that have been evaluated as "eligible or are currently unevaluated" for nomination to the NRHP within the West Rim Project Area. There is one site that is not eligible to the NRHP but is protected. This site is a known burial; South Dakota Codified Law 34-27 prohibits the disturbance of known human remains or funerary objects. An additional 239 properties located inside the West Rim Project Area have been evaluated as not eligible for nomination to the NRHP.

Specific areas of concerns for heritage resources include: A) the protection of NRHP eligible and unevaluated cultural resource sites, B) consultation with local American Indian groups and C) the protection of culturally significant areas, traditional cultural properties (TCP's) and recent and historic graves. Currently there are no known TCPs in the West Rim Project Area.

Of the total 43,024 acres of land administered by the Forest Service under analysis for this project, 100 percent has been surveyed; this does not include 4,456 acres of private land not included in potential treatment planning. The 43,024 acres previously mentioned have been inventoried for heritage resources to current Level III standards. These projects were primarily Black Hills National Forest timber and range projects.

BHNF Heritage Reports R2005020300204 (NH-07-05) & R20050203000230 document a complete Level I literature review and Level III inventory of all remaining acres of potential treatment inside the West Rim Analysis Area. These reports were prepared to assist in determining how many and what types of previously documented heritage resources are located within the West Rim Analysis Area perimeter. These complete reviews, inventories, and findings of additional historic properties are included in the Archaeological Investigations of the West Rim Analysis Unit, Black Hills National Forest, Lawrence County, South Dakota (Smith, 2005) and A Level III Cultural Resource Inventory Report for the Westrim Analysis Area, Black Hills National Forest, Lawrence County, South Dakota (Kinsman, 2007). The current analysis will help determine how future projects and natural erosion will potentially affect cultural resources within the West Rim Analysis 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 September 14, 2007. Request for copies of the cultural resource report for West Rim were made by two tribes: Mr. Dewey Tsonetokoy (NAGPRA coordinator for the Kiowa Tribe, Carnegie, Oklahoma) and Mr. Conrad Fisher (Tribal Historic Preservation Officer for the Northern Cheyenne Tribe, Lame Deer, Montana). Copies of the report were sent to both parties.

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, Rosebud Sioux THPO, Ogalala Sioux THPO, Northern Arapahoe THPO, and the Lower Brule Cultural Office for review. No comments have been received by the SHPO or any THPOs to date; the reports were sent on November 2, 2007. All NRHP eligible and unevaluated cultural resource sites discovered during these and subsequent inventories will be protected from effects related to management activities.

3.14.3 Environmental Consequences for Heritage Resources

Effects Common to All Alternatives

Direct Effects

Potential direct impacts to historic properties are: road construction, road reconstruction, timber harvest with heavy equipment, skidding logs, timber landing, loading, and hauling. Fuels reduction activities can affect these resources through 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.

Indirect Effects

Indirect 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 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.

Alternative A (No Action) - Direct and Indirect Effects

Alternative A (No Action) would not directly affect any heritage resources. Alternative A (No Action) would not provide any mitigation measures for resource protection or stabilization of currently affected sites. No indirect effects resulting from management activities would occur.

Alternative A (No Action) - Cumulative Effects

Because no direct or indirect effects would occur as a result of management actions under Alternative A (No Action), no cumulative effects to heritage resources would occur.

Alternative B (Proposed Action) - Direct and Indirect Effects

A review of the West Rim Cultural Resource report (Kinsman 2007), show that there are 290 cultural properties within the Project Area. In Alternative B (Proposed Action) treatment areas there are 95 cultural properties. There are 76 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 18 eligible or unevaluated cultural properties and one ineligible property (grave) that have the potential to be affected by the treatments.

These culturally significant properties cited for protection, are located within or adjacent to potential harvest units, fuel reduction areas, and planned road activities. These sites are listed according to their Smithsonian site number relative to proposed actions under Alternative B and specific mitigation measures for each site are listed in Appendix B.

Potential direct effects to historic properties are road construction, road reconstruction, timber harvest with heavy equipment, skidding logs, timber landing, loading, and hauling. Fuels reduction activities can affect these resources from 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 have the potential to expose or disturb buried archaeological deposits. Archaeological resources once disturbed are no longer of value scientifically or for interpretive use.

Indirect effects from road construction and reconstruction include potential erosion in areas of exposed native road surfaces. Additional measures include vehicular access to the historic properties, which could promote future artifact hunting, or disturbance to contributing features and artifacts by vandals. Indirect 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 by recreational vehicles and increase potential for possible 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.

Adequate intensive heritage inventories have been performed for all analysis acres in Alternative B. There would be no direct or indirect effects to heritage resources within the Project 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 B (Proposed Action) - Cumulative Effects

The area analyzed for cumulative effects is the seventh level watersheds that comprise the West Rim Project Area. The timeframe considered was 10 years, the expected duration of management activities proposed by the West Rim Project.

There would be no cumulative effect to heritage resources within this Project Area provided that all eligible and potentially eligible properties, Traditional Cultural Properties, and culturally significant areas are avoided and specific mitigation measures developed in consultation with the SHPO, THPO's and other interested parties are adhered to. In addition, the site-specific mitigation measures outlined for known significant historic properties provided in the West Rim Heritage Resource Report (Kinsman 2007) must be followed prior to project implementation. As a result, it is expected that no potential direct, indirect, or cumulative impacts to cultural resources would occur during implementation of Alternative B.

Alternative C - Direct and Indirect Effects

A review of the West Rim Cultural Resource report (Kinsman 2007), show that there are 290 cultural properties within the Project Area boundary. In the Alternative C treatment areas there are 113 cultural properties. There are 91 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 21 eligible or unevaluated cultural properties and one ineligible property (grave) that have the potential to be affected by the treatments proposed in Alternative C. 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 are listed according to their Smithsonian site number relative to proposed actions under Alternative C and specific mitigation measures for each site are listed in the West Rim Heritage Resource Report (USDA-Forest Service 2007f).

Potential direct impacts or affects to historic properties are road construction, road reconstruction, timber harvest with heavy equipment, skidding logs, timber landing, loading, and hauling. Fuels reduction activities can affect these resources from 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 affects mentioned have the potential to exposed and or disturb buried archaeological deposits. Archaeological resources once disturbed are no longer of value scientifically or for interpretive use.

Indirect 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, 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.

Adequate intensive heritage inventories have been performed for all analysis acres in Alternative C. There would be no direct effect to heritage resources with 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.

Alternative C - Cumulative Effects

The area analyzed for cumulative effects is the seventh level watersheds that comprise the West Rim Project Area. The timeframe considered was 10 years, the expected duration of management activities proposed by the West Rim alternatives.

There would be no cumulative effect to heritage resources within this Project Area provided that all eligible and potentially eligible properties, Traditional Cultural Properties, and culturally significant areas are avoided and specific mitigation measures developed in consultation with the SHPO, THPO's and other interested parties are adhered to. In addition, the site-specific mitigation measures outlined for known significant historic properties provided in the West Rim Heritage Resource Report (USDA-Forest Service 2007f) must be followed prior to project implementation. As a result, it is expected that no potential direct, indirect, or cumulative impacts to cultural resources would occur during implementation of Alternative C.

There would be no effect to heritage resources within this Project Area provided that all eligible and potentially eligible properties, Traditional Cultural Properties, and culturally significant areas are avoided and specific mitigation measures developed in consultation with the SHPO, THPO's and other interested parties are adhered to. In addition, the site-specific mitigation measures outlined for known significant historic properties provided in the West Rim Heritage Resource Report (USDA-Forest Service 2007f) must be followed prior to project implementation. As a result, it is expected that no potential direct, indirect, or cumulative impacts to cultural resources would occur during implementation of Alternative C.

3.15 Socio-Economics

3.15.1 Introduction

Forest resources provide economic components of community sustainability by providing for a wide variety of uses, values, products, and services. The resources within the West Rim Project Area have provided an array of economic benefits to the residents of the Black Hills area. These resources range from sustenance for American Indian tribes, logs used to construct early mining camps, towns and mines, ties used for railroad construction, and the lumber harvested by the timber industry, which remains active today.

The Black Hills National Forest is annually one of the top timber-producing forests in the National Forest System. The Black Hills have exhibited an extraordinary ability to produce ponderosa pine naturally (i.e., without tree planting), which allows sustainable timber harvest to continue at a relatively high rate. Consequently, many of the communities in and around the Black Hills are at least partially dependent on jobs and revenue generated by the local timber industry.

3.15.2 Existing Conditions for Socio-Economics

Timber harvest has contributed greatly to the area's economy. Initial Euro-American settlement of the Black Hills began in the 1870s and was followed by rapid growth of the area during the gold rush. Early settlers used timber harvested from the Black Hills to construct buildings, railroads, and mining facilities. The first ever timber sale on a national forest took place in 1898 near Nemo, South Dakota, which is now part of the Northern Hills Ranger District. Today, the Black Hills National Forest is one of the top timber-producing forests in the National Forest System. This timber supply is a important component of the support of local and regional communities, as well as contributing to the area's supply of goods and services. Overall, the Black Hills National Forest's practices have had a positive influence on the economy of the Black Hills area.

Several communities in the Black Hills region, including Spearfish and Hill City, South Dakota, and Hulett, Wyoming, are home to lumber mills that provide a substantial number of jobs and are an important component of the local economy. These mills rely on timber from the Black Hills National Forest to continue operations.

3.15.3 Economic Analysis

The following is a summary of the analysis used to calculate a variety of financial measures describing the alternatives in this EIS. The Quick Silver program was used to perform the analysis (QS Version 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 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 West Rim Project Area that are not included in this analysis (e.g., recreation management, Christmas tree cutting, 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 activities.

This EIS discusses a no action alternative and two action alternatives for managing the West Rim Project Area for the next ten to fifteen years. The financial analysis includes those actions connected to the vegetation treatments for fire and fuels reduction needs and related actions that are planned over this management timeframe. The only benefits included in the analysis were the revenues generated from the volume of timber harvested per alternative. This analysis does not include revenues generated in the local and regional economies related to wages, equipment and supplies purchased, and taxes paid. No values are presented for Alternative A because no actions are proposed, so no costs or benefits related to this project would be generated.

The action alternatives described in this EIS are consistent with national initiatives and policy such as the National Forest Management Act, National Fire Plan, Healthy Forests Initiative, and direction provided by the Forest Plan and associated economic assumptions. Any future project proposals will receive a separate environmental analysis, including an economic analysis, as appropriate. Table 45 displays the financial measures summarized by alternative.

Table 45. West Rim Estimated Costs and Benefits

	Alternative A	Alternative B	Alternative C
Present Net Value (PNV)	$0	-$7,934,500	-$8,679,651
Benefit/Cost Ratio (B/C)	0.00	0.37	0.35
Benefits (PV)	$0	$4,577,200	$4,577,200
Costs (PV)	$0	$12,511,700	$13,256,852

The only benefit calculated for the alternatives was the sale of softwood timber. Costs include road construction, prescribed burning, sale prep and administration, non-commercial thinning, and post-sale

activities. A complete list of the costs and benefits for each alternative and the value associated with each is located in the West Rim project file.

Costs

Sale preparation/administration costs are based upon a 3-year average of costs for the Forest. Normally, all of the administration portions of costs are spread out over the contract period. Rather than trying to develop specific assumptions on what costs occur in what year, all the costs are lumped in year 1. This assumption results in a lower economic value than if the costs were spread out. Road costs are based upon the estimated costs given the amount of work that needs to be done. Costs for pre-commercial thinning, fuels treatments, and weed control are all based on the recent planning costs used in recent timber sales. The costs include district administration and overhead. Also, some design criteria costs have been added in.

Benefits

The stumpage values are the average experienced on the forest as documented by the Regional Office. The revenues are assumed to occur all at once. This assumption simplifies the situation that would normally occur with the revenues occurring throughout the life of the sale. This assumption by itself would tend to raise the economic value of the project, but it is consistent with the assumption on sale administration costs, which tend to lower the economic value of the project.

The results of the Quick Silver analysis are displayed in Table 45. The values shown are intended to show relative efficiency of each alternative and serve as a means of comparing alternatives. The values will fluctuate with changes in costs and stumpage values and do not reflect actual costs and revenues.

Alternative A (No Action)

Although costs associated with Alternative A are not integrated into this financial analysis, the actual cost of not taking action could potentially be much higher than the action alternatives in both economic and environmental terms. Recent wildfires on the Black Hills and in the western United States have incurred costs in the millions of dollars for suppression alone. In the Black Hills, suppression costs for the recent Battle Creek Fire were estimated at $6.5 million and the Jasper Fire around $11.5 million. Costs of rehabilitation, economic loss of resources and property values are additional costs of these wildfires.

Alternatives B (Proposed Action) and C

The cost of fully implementing Alternative B exceeds the revenues generated by approximately $7.9 million while the cost of implementing Alternative C would exceed revenues by approximately $8.7 million. Revenues generated from Alternative B ($4.6 million) would be identical to those generated by Alternative C because the amount of timber harvest proposed under each action alternative is identical. Implementation costs of Alternative B ($12.5 million) are slightly less than Alternative C ($13.3 million) because of additional oversight and monitoring costs associated with the structure buffer treatments and additional thinning, piling and burning treatments under Alternative C. To fully implement either action alternative, additional funding, such as appropriated fuels dollars or other sources, would be necessary to accomplish the proposed activities.

3.15.4 Environmental Justice

Environmental justice is a required analysis per USDA guidelines established for Executive Order 12898. The Proposed Action and alternatives have been examined in regards to environmental justice and no evidence that this project will disproportionately affect any minority or low-income population including any American Indian groups has been found.

3.16 Irreversible and Irretrievable Commitments of Resources

3.16.1 Forest Resources

The proposed actions would not cause any irreversible commitments of forest resources. The proposed new road construction would cause a temporary loss of timber productivity from lands used for transportation. The lands used for new roads would be an irretrievable commitment to this use and would result in a reduction in the timber productivity of the area as well as the loss of a portion of the different cover types and structural stages through which these roads would be constructed. However, these areas could be reforested and brought back into timber production if the roads were closed and allowed to revegetate. Therefore, the building of roads would not be an irreversible commitment of resources.

3.16.2 Wildlife

There would be no irreversible or irretrievable commitments of resources related to fish and wildlife species or their habitats. Loss of late successional forest could potentially represent an irretrievable loss of habitat, as 56 acres of SS5 would be converted to an earlier successional stage.

3.16.3 Hydrology and Soils

Any soil lost from the Project Area would be considered an irreversible and irretrievable commitment of the soil resource. WCPs and BMPs would be used to minimize soil productivity losses from timber harvesting and road building. There would not be irretrievable loss of soil productivity, as landings and skid trails would be ripped and seeded where productivity has been reduced.

None of the proposed activities by themselves would result in irretrievable effects to water quality.

3.17 Short-term Uses and Long-term Productivity

3.17.1 Forest Resources

Alternatives B and C would show a short-term reduction in the amount of standing timber volume in the area following the proposed commercial timber harvest. The proposed commercial harvests would remove trees that could grow larger and provide timber in the future if left uncut. However, the proposed regeneration harvests (clearcut and overstory removal harvests) would be expected to improve long-term timber yields by creating additional younger stands and improving the distribution of pine stand age classes. A forest with a higher proportion of younger stands than is currently in the Project Area would be more likely to produce higher sustainable yields in the future.

The commercial and pre-commercial thinning proposed under Alternatives B and C would improve stand stocking levels resulting in increased tree and stand growth rates. The decrease in stocking levels would also improve the vigor of the remaining trees making them less susceptible to attack by insect and disease, particularly mountain pine beetles. These treatments are also likely to improve future timber yields.

3.17.2 Fire and Fuels

The proposed treatments would change the structural stages and related fire hazard ratings for forested stands. Potential short-term impacts could occur through disturbance of wildlife and plant habitat, soil disturbance, and stream sedimentation, but the changes in stand composition would reduce the long-term potential for crown fire propagation. Overall, a lower crown fire hazard would result in less environmental damage to wildlife, water, range, recreation, and private lands and structures.

3.17.3 Wildlife

As provided for by the amended Forest Plan, specific standards, objectives, and guidelines would be applied during implementation of the action alternatives through the use of specific design criteria. Adherence to these requirements ensures that long-term productivity of the land is not impaired by short-term uses. There would be short-term impacts to vegetation, habitat, and fish and wildlife species during the construction of roads and vegetation treatments. However, the goals of the project are to increase ecological productivity in the long-term. Monitoring conducted at the Forest level would be applied to allow for adaptive management of the resources to protect long-term productivity.

3.17.4 Botany

The proposed vegetative treatments and prescribed burning have the potential to negatively impact some plant Species of Local Concern within the West Rim Project Area. However, these short term losses may be off-set by long term reductions in the potential losses from intense wildfires.

3.17.5 Hydrology and Soils

The soil resource is a key ingredient for maintaining the long-term productive potential for an area. Erosion and effects that may be detrimental to the soil resource would be minimized through use of careful design, WCPs, and BMPs. Soil protection measures in the Forest Plan Standards and Guidelines would maintain critical soil parameters and nutrients, ensuring long-term productivity.

Short-term effects of the proposed activities could include a small change in sediment delivery. Where increased sediment delivery is predicted, it could continue for an indefinite period of time, depending on vegetative recovery and maintenance of roads. These effects are negligible and would not affect long-term productivity. Beneficial uses would not be adversely affected.

3.17.6 Scenery

Short-term impacts of timber harvesting would have some scenic impacts. Long-term, these vegetation treatments would increase the vegetative diversity and therefore would have a positive effect on scenic values.

3.18 Unavoidable Adverse Impacts

3.18.1 Fire and Fuels

Some minor, short-duration impacts are expected from conducting prescribed burning. Potential impacts would include short-term decreases in air quality due to smoke, and would be addressed during the preparation of prescribed fire burning plans. Mitigation measures would be developed and implemented as needed.

3.18.2 Wildlife

Wildlife habitat for certain species would be adversely affected to varying levels with implementation of the action alternatives. During implementation of the treatments, noise, soil compaction, fire, and vegetation removal would reduce the amount of available habitat. Likewise, there may be a direct take in some species and their nests. Over the long-term, the diversity and functionality of the habitat would increase.

3.18.3 Botany

Some potential habitat for R2 Sensitive plant species and SOLC plant species would be lost due to the construction of roads through suitable habitat under the Alternatives B and C. While the amount of habitat loss would be minimized through the implementation of the design criteria, some suitable habitat would be altered through road building activities.

3.18.4 Hydrology and Soils

Long-term soil productivity would not be adversely affected. However, soil erosion may contribute to a slight decrease in soil productivity. None of the proposed activities would result in an unavoidable adverse environmental effect on water quality.

3.18.5 Scenery

Scenic quality would be affected adversely for some observers by the various levels of vegetation treatment and other actions proposed. The clear cut treatment located at the far northern end of the Project Area would be in contrast to the existing scenery values associated with scenic class, sensitivity, and scenic integrity objective. However, the viewing area is primarily in the middleground and background from the I-90 and Highway 14A corridors and is not in close proximity to any major recreational areas; therefore, it would not be considered a major visual impact. Mitigation measures would be implemented to protect scenic quality. Mitigation is recommended for specific treatment areas (JW Associates 2008g). Edges of the treatment units would be feathered into untreated stands to mimic natural forest opening edge typically found in the landscape. Layout and marking of timber sale units would comply with Forest-wide marking guides in effect at the time of implementation.

3.19 Consistency with the Forest Plan

The proposed actions are designed to meet all the applicable Forest Plan standards. Both Alternatives B and C are consistent with the Forest Plan standards for all resources. Detailed analysis of how the actions would comply with Forest Plan standards are contained in the Resource Reports.

3.20 Other Required Disclosures

3.20.1 Wildlife

No waters would be impounded or diverted as part of the project so coordination with the US Fish and Wildlife Service under the Fish and Wildlife Coordination Act is not required. No coordination with the with the US Fish and Wildlife Service is required under the Endangered Species Act, as no Threatened or Endangered Species occur on the Project Area.

3.20.2 Botany

No coordination with the with the US Fish and Wildlife Service is required under the Endangered Species Act, as no Threatened or Endangered Species occur on the Project Area.

3.20.3 Hydrology and Soils

E.O. 11988 – Floodplain Management

The West Rim project would be in compliance and meets the requirements of the Executive Order for Floodplain Management.

E.O. 11990 – Protection of Wetlands

The West Rim project would be in compliance and meets the requirements of the Executive Order for Protection of Wetlands.

Clean Water Act of 1977

All alternatives for the West Rim project would not degrade water quality and would be in compliance and meet the requirements of the CWA.

Section 402

Discharge Permits –This permit applies to point sources. There would not be any point sources of pollutants as a result of this project and silvicultural activities are exempt from this permit. Any potential source of pollutants as a result of this project would be labeled as non-point and this project would meet and comply with the Forest Plan Standards, which incorporate WCPs and BMPs that are designed to meet water quality standards through control of non-point source of pollutants.

Storm Water Associated with Construction Activities – Silvicultural activities, including road construction to access treatment areas, are exempt from this permit. As mentioned above, Forest Plan Standards would be implemented to prevent and minimize pollution.

Section 404

Silvicultural activities and roads associated with these activities are exempt from this permit as long as the 15 mandatory BMPs are implemented as listed in 33 CFR 323.4. Those BMPs are listed below:

(i) Permanent roads (for farming or forestry activities), temporary access roads (for mining, forestry, or farm purposes) and skid trails (for logging) in waters of the U.S. shall be held to the minimum feasible number, width, and total length consistent with the purpose of specific farming, silvicultural or mining operations, and local topographic and climatic conditions;

(ii) All roads, temporary or permanent, shall be located sufficiently far from streams or other water bodies (except for portions of such roads which must cross water bodies) to minimize discharges of dredged or fill material into waters of the U.S.;

(iii) The road fill shall be bridged, culverted, or otherwise designed to prevent the restriction of expected flood flows;

(iv) The fill shall be properly stabilized and maintained during and following construction to prevent erosion;

(v) Discharges of dredged or fill material into waters of the United States to construct a road fill shall be made in a manner that minimizes the encroachment of trucks, tractors, bulldozers, or other heavy equipment within waters of the United States (including adjacent wetlands) that lie outside the lateral boundaries of the fill itself;

(vi) In designing, constructing, and maintaining roads, vegetative disturbance in the waters of the U.S. shall be kept to a minimum;

(vii) The design, construction and maintenance of the road crossing shall not disrupt the migration or other movement of those species of aquatic life inhabiting the water body;

(viii) Borrow material shall be taken from upland sources whenever feasible;

(ix) The discharge shall not take, or jeopardize the continued existence of, a threatened or endangered species as defined under the Endangered Species Act, or adversely modify or destroy the critical habitat of such species;

(x) Discharges into breeding and nesting areas for migratory waterfowl, spawning areas, and wetlands shall be avoided if practical alternatives exist;

(xi) The discharge shall not be located in the proximity of a public water supply intake;

(xii) The discharge shall not occur in areas of concentrated shellfish production;

(xiii) The discharge shall not occur in a component of the National Wild and Scenic River System;

(xiv) The discharge of material shall consist of suitable material free from toxic pollutants in toxic amounts; and

(xv) All temporary fills shall be removed in their entirety and the area restored to its original elevation.

Chapter 4. Index

Chapter 5. Bibliography

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Chapter 6. Glossary

A

Alternative—A mix of management prescriptions applied to specific land areas to achieve a set of goals and objectives. The alternative provides management direction for the proposed project that reflects identified public and management concerns for the Project Area.

B

Best Management Practices (BMPs)—Practices determined by the state to be the most effective and practical means of preventing or reducing the amount of water pollution generated by nonpoint sources to meet water quality goals.

Big Game—Those species of large mammals normally managed as a sport hunting resource.

Biological Diversity (Biodiversity)—The relative distribution and abundance of different plant and animal communities and species within an area.

Biological Evaluation—A documented USFS review of activities in sufficient detail to determine how an action or proposed action may affect any threatened, endangered, proposed, or sensitive species.

Board Foot (bd.ft.)—The amount of wood equivalent to 1 foot by 1-inch thick.

Broadcast Burn—Allowing a prescribed fire to burn over a designated area within well-defined boundaries for reduction of a fuel hazard or as a silvicultural treatment or both.

Browse—Twigs, leaves, and young shoots of trees and shrubs on which animals feed.

C

Canopy—The more-or-less continuous cover of branches and foliage formed collectively by the crown of adjacent trees.

Code of Federal Regulations (CFR)—The listing of various regulations pertaining to management and administration of the National Forests.

Compaction—The packing together of soil particles by forces exerted at the soil surface, resulting in increased soil density.

Condition Class—A grouping of timber stands into size-age-stocking classes for Forest planning.

Conifer—Any of a group of needle and cone-bearing evergreen trees.

Council on Environmental Quality (CEQ)—An advisory council to the President, established by NEPA. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Cover—Vegetation used by wildlife for protection from predators or to escape the adverse effects of weather.

Cultural Resources—The remains of sites, structures, or objects used by humans in the past-historic or prehistoric.

Cumulative Effect—The impact on the environment that results from the incremental impact of the action when added to other actions. Cumulative impacts can also result from individually minor, but collectively significant, actions taking place over a period of time.

D

Decommissioning—This term is used to refer to a specific type of road closure. On a decommissioned road, access would be controlled by means of a moderately sized berm or "tank trap" impassable to vehicles but capable of being easily bulldozed to permit vehicle passage if the road is recommissioned in the future. For all decommissioned roads, water bars are installed, the road bed is seeded, all culverts are removed, and self-maintaining cross-road drainage is provided.

Developed Recreation—Recreation dependent on facilities provided to enhance recreation opportunities in concentrated use areas. Examples are ski areas, resorts, and campgrounds.

Diameter at Breast Height (dbh)—The diameter of a tree measured 4 ft, 6 inches above the ground.

Dispersed Recreation—Recreation that occurs outside of developed recreation sites requiring few, if any, facilities or other improvements and includes such activities as hunting, hiking, viewing scenery, and cross-country skiing.

Displacement of Soil—The movement of the forest floor (litter, duff, and humus layers) and surface soils from one place to another by mechanical forces such as a blade used in piling and windrowing. Mixing of surface soil layers by disking, chopping, or bedding operation is not considered displacement.

E

Ecosystem—Any community of organisms along with its environment, forming an interacting system.

Effects (or impacts)—Environmental consequences (the scientific and analytical basis for comparison of alternatives) as a result of a proposed action. Effects may be either direct, which are caused by the action and occur at the same time and place, or indirect, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable or cumulative.

Endangered Species—Any plant or animal species that is in danger of extinction throughout all or a significant portion of its range (Endangered Species Act of 1973).

Endemic—Native to or confined to a certain region.

Environment—The aggregate of physical, biological, economic, and social factors affecting organisms in an area.

Environmental Assessment (EA)—A concise public document which serves to (a) briefly provide sufficient evidence and analysis for determining whether to prepare an EIS or a finding of No Significant Impact, (b) aid an agency's compliance with NEPA when no EIS is necessary, or (c) facilitate preparation of an EIS when necessary.

Environmental Impact Statement (EIS)—A detailed summary prepared by the responsible official in which a major federal action that significantly affects the quality of the human environment is described, alternatives to the proposed action provided, and the effects analyzed.

Epidemic—The populations of plants, animals and diseases that build-up, often rapidly, to highly abnormal and generally injurious levels.

Erosion—The detachment and transport of individual soil particles by wind, water, or gravity.

F

Fauna—Animals, including lesser forms such as insects, mites, etc.

Fire Regime Condition Class—A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning. The five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant overstory vegetation.

Floodplain—The lowland and relatively flat areas adjoining inland and coastal waters, including, at a minimum, that area subject to a 1 percent or greater chance of flooding in any given year.

Flora—Plants

Forage—All browse and non-woody plants that are available to livestock or game animals and used for grazing or harvested for feeding.

Forb—An herbaceous plant that is not a graminod.

Foreground—That part of a scene, landscape, etc., that is nearest to the viewer, and in which detail is evident, usually ¼ to ½ mile from the observer.

Fuel Treatment—Manipulation or reduction of natural or activity fuels (generated by a management activity such as slash left from logging) to reduce fire hazard.

Fuels—Combustible materials present in the forest that potentially contribute a significant fire hazard.

H

Habitat—The sum total of environmental conditions of a specific place occupied by a wildlife species or a population of such species.

Habitat Type—An aggregation of all land areas potentially capable of producing similar plant communities at climax stage.

I

Immediate Foreground—The part of the foreground that is extremely critical for visual detail, usually within 400 feet of the observer.

Indicator Species—See Management Indicator Species.

Indirect Effects—Secondary effects that occur in locations other than the initial action or significantly later in time.

Interdisciplinary (ID) Team—A group of professional specialists with expertise in different resources that collaborate to develop and evaluate management alternatives.

Interdisciplinary Approach—Utilization of one or more individuals representing areas of knowledge and skills focusing on the same task, problem, or subject. Team member interaction provides needed insight to all stages of the process.

Intermittent Stream—A stream that runs water in most months, but does not run water during the dry season of most years.

Invertebrates—Animals having no backbone such as earthworms, insects, and lesser animals.

Irretrievable—Applies to losses of production, harvest, or a commitment of renewable natural resources. For example, some or all of the timber production from an area is irretrievably lost during the time an area is used as a winter sports (recreation) site. If the use is changed, timber production can be resumed. The production lost is irretrievable, but the action is not irreversible.

Irreversible—Applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors that are renewable only over long time spans, such as soil productivity. Irreversible also includes loss of future options.

Issue—A subject or question of public discussion or interest to be addressed or discussed in the planning process.

L

Landtype—A unit of land with similar designated soil, vegetation, geology, topography, climate, and drainage. The basis for mapping units in the land systems inventory.

Limiting Factor—The environmental influence that exceeds the tolerance limit of an animal to restrict it in its activities, functions, or geographic range.

Litter—An organic surface soil layer usually composed of identifiable leaves, branches, or other vegetative material, and animal remains.

M

Management Area—Geographic areas, not necessarily contiguous, that have common management direction, consistent with the Forest Plan allocations.

Management Direction—A statement of multiple use and other goals and objectives, along with the associated management prescriptions and standards and guidelines to direct resource management.

Management Indicator Species—A species selected because its welfare is presumed to be an indicator of the welfare of other species sharing similar habitat requirements. A species of fish, wildlife, or plants that reflect ecological changes caused by land management activities.

Middleground—The part of a scene or landscape that hits between the foreground and background zones.

Mitigation—Actions to avoid, minimize, reduce, eliminate, replace, or rectify the impacts of a management practice.

Monitoring—The periodic evaluation on a sample basis, of management practices to determine how well objectives have been met and how closely management standards have been applied.

Mortality—In forestry, trees in a stand that die of natural causes.

N

National Environmental Policy Act (NEPA) Process—An interdisciplinary process that concentrates decisionmaking around issues, concerns, alternatives, and the effects of alternatives on the environment.

National Forest Management Act (NFMA)—Law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring preparation of Regional Guides and Forest Plans, and the preparation of regulations to guide that development.

Natural Regeneration—Reforestation of a site by natural seeding from the surrounding trees. Natural regeneration may or may not be preceded by site preparation.

Noxious Weed—A plant species that is highly injurious or destructive and has a great potential for economic impact.

O

Obliteration—Obliteration of an existing road would involve removal of all culverts, establishing permanent drainages, and recontouring of the road surface.

P

Pathogen—A specific causative agent of disease, such as a virus.

Peak Flow—The greatest flow attained during the melting of the winter snowpack.

Perennial Streams—Streams that flow continuously throughout the year.

Pioneer Species—A plant capable of invading a bare site (newly exposed soil surface) and persisting there until replaced by another species or community as succession progresses.

Plant Community—An assembly of plants living together.

Preferred Alternative—The alternative recommended for implementation in the EIS (40 CFR 1502.14).

Prescribed Burning—The application of fire to fuels in either a natural or modified state under such conditions as to allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives (i.e., silviculture, wildlife management, reduction of fuel hazard, etc.).

Prescription—Management practices selected and scheduled for application on a designated area to attain specific goals and objectives.

Project Area— The Project Area is located in the northern Black Hills immediately south of Spearfish, South Dakota. The Project Area includes 43,028 acres of National Forest System (NFS) lands and 10,129 acres of non-NFS lands for a total of 53,157 acres.

R

Recreation Opportunity Spectrum (ROS)—A system for defining the types of outdoor recreation opportunities the public might desire and identifies that portion of the spectrum a given area might be able to provide. It is used for planning and managing the recreation resource and recognizes recreation activity, setting, and experience opportunities.

Restricted Road—A National Forest road or segment that is restricted from a certain type of use or all uses during certain seasons of the year or yearlong. The use being restricted and the time period must be

specified. The closure is legal when the Forest Supervisor has issued and posted an order in accordance with 36 CFR 261.

Riparian—Pertaining to areas of land directly influenced by water. Riparian areas usually have visible vegetative or physical characteristics reflecting this water influence. Stream sides, lake borders, or marshes are typical riparian areas. Riparian vegetation borders watercourses, lakes, or swamps; it requires a high water table.

Road—A vehicle travel way of over 50 inches wide.

Road Maintenance—The upkeep of the entire Forest Development Transportation Facility including surface and shoulders, parking and side areas, structures, and any traffic control devices as are necessary for its safe and efficient utilization.

Roadless Area—A National Forest System area that is larger than 5,000 acres or, if smaller than 5,000 acres, is contiguous to a designated wilderness or primitive area; contains no roads, and has been inventoried by the Forest Service for possible inclusion into the wilderness preservation system.

S

Scoping—The procedures by which the Forest Service determines the extent of analysis necessary for a proposed action, i.e., the range of actions, alternatives, and impacts to be addressed, identification of significant issues related to a proposed action, and establishing the depth of environmental analysis, data, and task assignment.

Sediment—Any material carried in suspension by water that will ultimately settle to the bottom. Sediment has two main sources—from the channel itself and from upslope areas.

Seedlings and Saplings—Non-commercial size young trees.

Sensitive Species—Those species identified by the Regional Forester for which population viability is a concern as evidenced by significant current or predicted downward trends in population numbers or density or habitat capability that would reduce a species' existing distribution.

Site Productivity—Production capability of specific areas of land.

Slash—The residue left on the ground after felling and other silvicultural operations and/or accumulating there as a result of storm, fire, girdling, or poisoning of trees.

Snag—A standing dead tree usually without merchantable value for timber products, but may have characteristics of benefit to some cavity nesting wildlife species.

Special Use Permit—A permit issued under established laws and regulations to an individual, organization, or company for occupancy or use of National Forest land for some special purpose.

Stand—A community of trees or other vegetation uniform in composition, constitution, spatial arrangement, or condition to be distinguishable from other adjacent communities.

Stand Replacing Fire—A fire that consumes an entire stand of trees. These fires are generally quite hot and can burn hundreds of acres.

Structural Stage – A classification based upon tree sizes and canopy closure. It is used for management purposes, habitat classification and fire hazard determinations.

Succession—The progressive changes in plant communities toward climax habitat.

Successional Stage—A stage or recognizable condition of a plant community which occurs during its development from the bare ground to climax habitat.

T

Thermal Cover—Vegetative cover used by animals to modify the adverse affects of weather.

Thinning—Cutting in even-aged stands to redistribute growth potential or benefit the quality of the residual stand.

Threatened Species—Any species of plant or animal that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Tiering—Refers to the coverage of general matters in broader EISs or EAs with subsequent other related statements in the EAs incorporated, by reference. The discussions contained in the previous document are incorporated, solely for issues specific to the statement subsequently prepared.

U

Unclassified Road—A road that is not constructed, maintained, or intended for long-term highway use, such as roads constructed for temporary access and other remnants of short-term use roads associated with fire suppression, timber harvest, and oil, gas, or mineral activities, as well as travel ways resulting from off-road vehicle use.

Understory—Vegetation (trees or shrubs) growing under the canopy formed by taller trees.

V

Vertebrates—Animals having a backbone, or a spinal column, including mammals, fishes, birds, reptiles, and amphibians.

Viewshed—Subunits of the landscape where the scene is contained by topography similar to a watershed.

Visual Quality Objective (VQO)— A US Forest Service system of indicating the potential expectations of the visual resource by considering the frequency an area is viewed and the type of landscape.

Visual Resource—The composite of landforms, water features, vegetative patterns, and cultural features which create the visual environment.

W

Water Yield—The measured output of the forest's streams.

Watershed—Entire area that contributes water to a drainage system or stream.

Wetlands—Areas that are inundated by surface or ground water with a frequency sufficient to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, wet meadows, river overflows, mud flats, and natural ponds.

Wilderness—All lands included in the National Wilderness Preservation System by public law; generally defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation.

Wildfire—Any wildfire not designated and managed as a prescribed fire with an approved prescription.

Wildland Fire Use—Naturally caused wildfires that are allowed to burn within controlled areas to achieve natural resource objectives.

Wildlife Diversity—The relative degree of abundance of wildlife species, plant species, communities, habitats, or habitat features.

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Chapter 7. List of Preparers

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Chapter 8. Recipients of Planning Documents

Recipients of FEIS

Hard copies of this FEIS were sent to the following agencies, organizations, businesses and individuals. Hard copies are being sent directly to those recipients required by federal regulations and to those who either submitted comments during the DEIS comment period or who specifically requested to receive a hard copy of the FEIS. Additional hard copies are available upon request. The FEIS is also available on the internet at:

http://www.fs.fed.us/r2/blackhills/projects/nepa/public_docs/West_Rim/index.shtml

Agencies

South Dakota Department of Environment and Natural Resources

South Dakota Department of Game, Fish and Parks

Shelly Deisch

Harley Noem

Ken Rost

United States Department of Agriculture

National Agricultural Library

United States Department of the Interior

Office of Environmental Policy and Compliance

United States Fish and Wildlife Service

United States Environmental Protection Agency

Office of Federal Activities, EIS Filing Section

Region 8, EIS Review Coordinator

Organizations

Black Hills Forest Resource Association

Biodiversity Conservation Alliance

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Prairie Hills Audubon Society

Nancy Hilding

SCOA

Spearfish Canyon Society

Businesses

Spearfish Forest Products

Bill Coburn

Neiman Enterprises

Individuals

Mark Barnett

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