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Moskee Project

Environmental Assessment

Bearlodge Ranger District, Black Hills National Forest
Crook County, Wyoming

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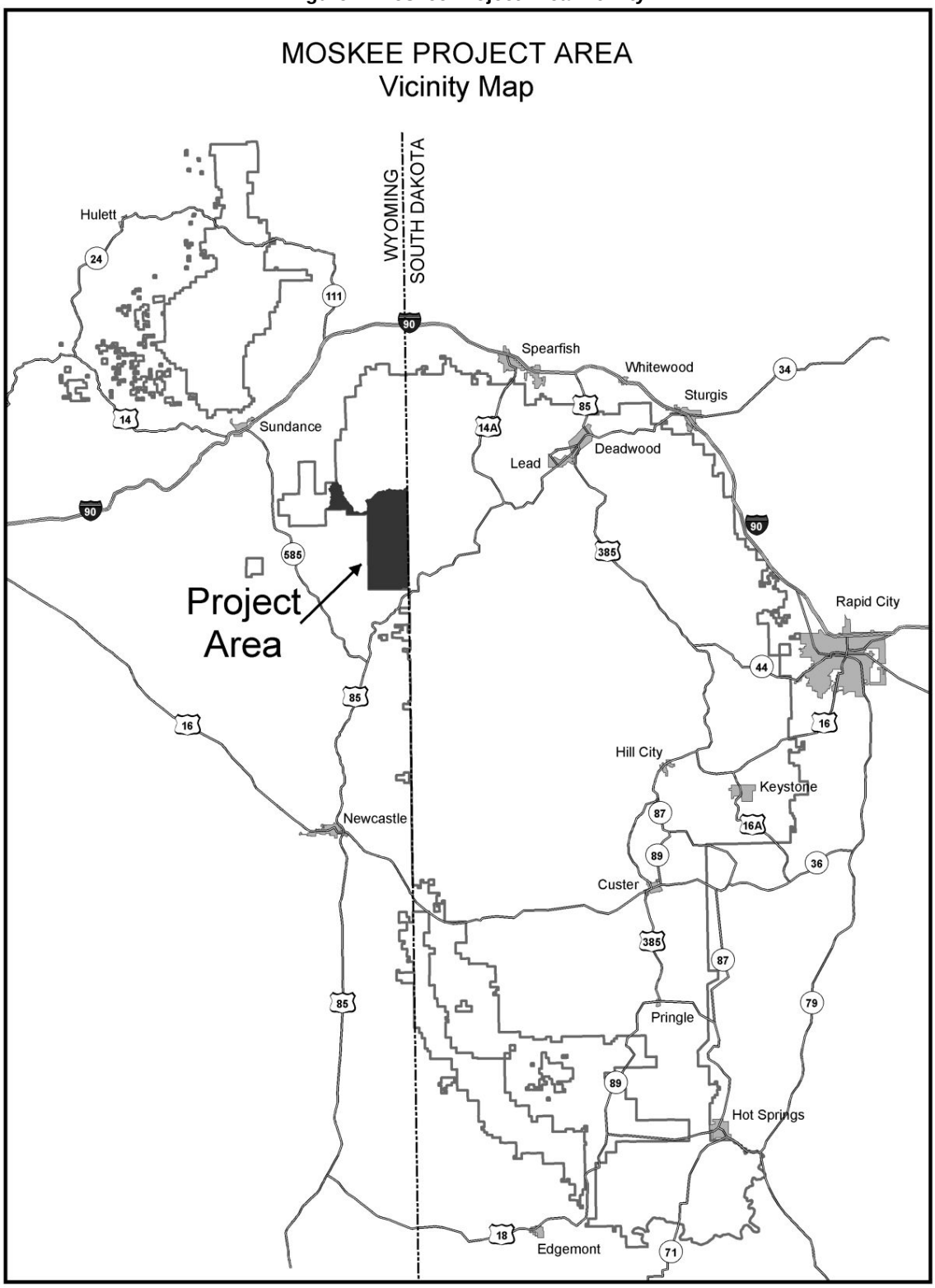
Figure 1. Moskee Project Area Vicinity



CHAPTER 1—PURPOSE AND NEED

Introduction

This chapter presents the proposed action and explains the purpose of and need for the Moskee project, decisions to be made, public involvement, and issue development. Site-specific needs for the Moskee project area and potential resource effects have been considered in the preparation of this environmental assessment (EA).

Project Location

The Moskee project area is located approximately 14 miles southeast of Sundance, Wyoming (Figure 1). The project area includes approximately 25,515 acres, with approximately 22,445 acres of National Forest System (NFS) lands and 3,070 acres under private ownership. Table 1 includes the legal description of the project area.

Table 1: Project Area Legal Description

Township	Range	Sections
49 North	60 West	4-9, 16-21, 28-33
49 North	61 West	1, 12, 13, 24, 25, 36
50 North	60 West	16-21, 28-33
50 North	61 West	16, 17, 20-29, 36
6th Principal Meridian		

The project area is forested primarily with ponderosa pine (18,107 acres, or 81 percent of the NFS acres). Stands dominated by quaking aspen are found on 2,473 acres (11 percent). Grassy meadows cover 1,815 acres (eight percent). Bur oak and paper birch each dominate 24 acres and there are two acres of unvegetated gravel pit. Aspen, oak, and birch are common understory components in many pine stands.

Main access to the project area is via Grand Canyon Road (National Forest System Road [NFSR] 875) via Moskee Road (County Road 141). Project area landmarks include Bald Mountain, Grand Canyon, Stanton Draw, and Scott-Hardy Spring (see Map 10 in Appendix 1).

Forest Plan Direction

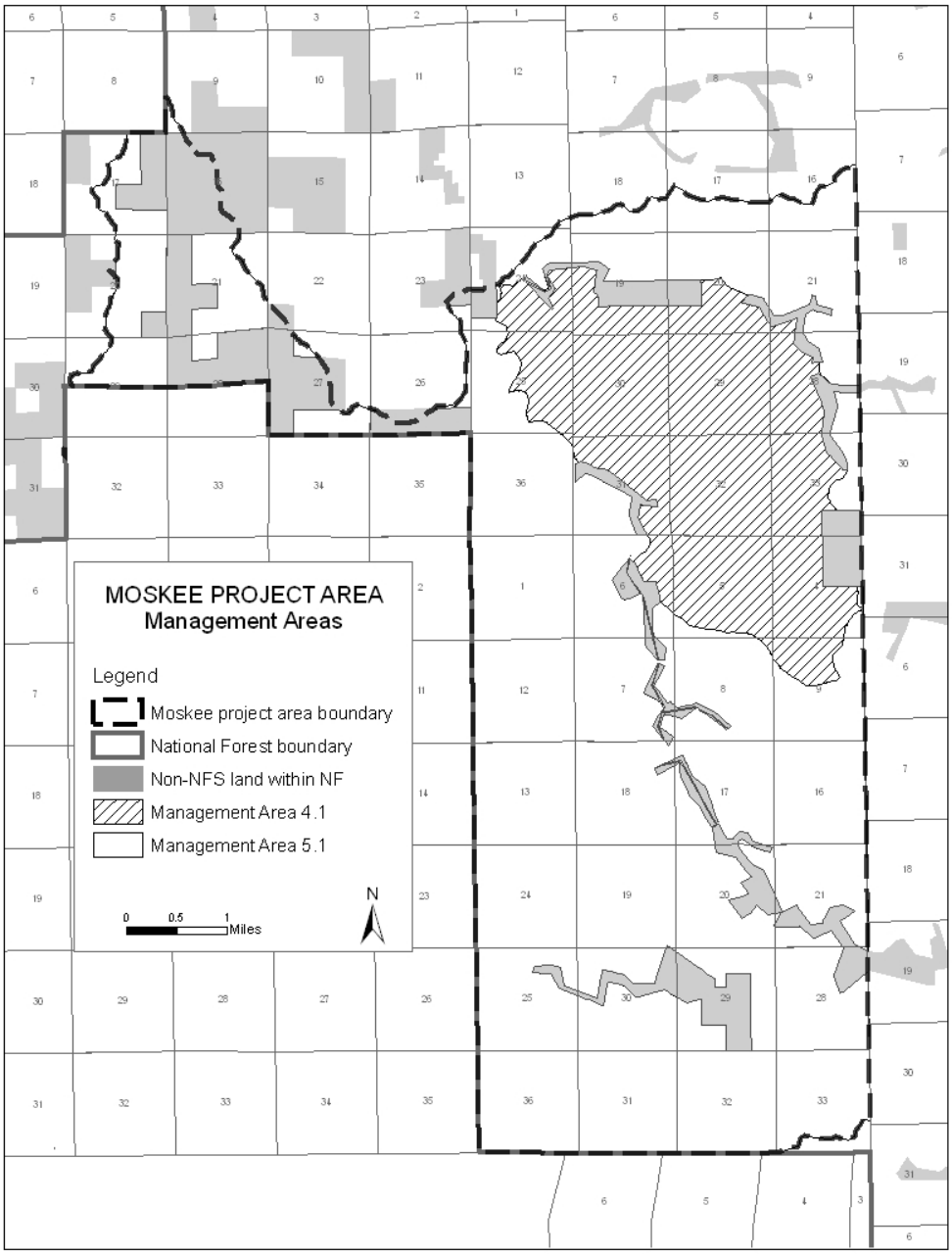
The Black Hills National Forest Land and Resource Management Plan, as amended (Forest Plan [USFS 2006]) includes multiple-use goals and objectives for management of the National Forest.

The Forest Plan also assigns a management emphasis to each portion of the Forest. For each designated management area (MA), Chapter 3 of the Forest Plan describes goals and objectives that apply in addition to Forest-wide direction. The project interdisciplinary team reviewed MA designations and found them appropriate. NFS lands in the Moskee project area are allocated to MAs 4.1 and 5.1 (Figure 2). MA 4.1, which comprises 5,161 acres (23 percent) of NFS lands in the project area, is managed for non-motorized recreation, production of timber and forage, visual quality, and a diversity of wildlife. Off-road motorized travel is restricted year-round to administrative travel only. Management of MA 5.1, which comprises 17,284 acres (77 percent) of the NFS lands in the project area, focuses on production of timber and forage, water yield,

diversity of wildlife, and a variety of other goods and services.

For detailed information, see Forest Plan pages III-45 through III-50 for MA 4.1 and pages III-64 through III-68 for MA 5.1.

Figure 2. Management Areas



Purpose and Need

The purpose of the Moskee project is to move the project area towards Forest Plan desired conditions. The following section compares relevant Forest Plan goals and objectives to the conditions that currently exist in the Moskee project area. The comparisons show where needs or opportunities for action exist.

Forest Plan Goal 2

Goal 2 of the Forest Plan is to manage for biologically diverse ecosystems (Forest Plan, pages I-6 through I-11). The Moskee project can contribute toward meeting this goal by addressing needs related to forest structure, hardwood communities, and meadow communities.

Forest Structure

Objectives 4.1-203 and 5.1-204[1] are to manage MAs 4.1 and 5.1, respectively, for certain percentages of structural stages. These objectives apply to the entire MA across the National Forest and are not intended to apply at the project level. Forest management in the project area could contribute toward achieving the Forest-wide objectives. Relative to the desired condition, existing structural stage distribution in MAs 4.1 and 5.1 across the National Forest is skewed towards mature forest and deficient in both young and late-succession forest. Distribution is similar in the project area, with approximately 90 percent of the pine acres forested with mature trees.

Hardwood Communities

Objective 201 is to manage for a minimum of 92,000 acres of aspen (double the current aspen acres), and 16,000 acres of bur oak (about a one-third 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 are to be focused away from the Bear Lodge Mountains (Forest Plan, page I-7).

In August 1936, nearly 7,400 acres were burned in the Moskee Fire. The area burned at that time comprises much of the western portion of the project (see Map 2 in Appendix 1). Subsequent planting of pine was largely unsuccessful, probably because the sites are better suited to aspen. These areas are, at best, mixed aspen and pine with the planted pine barely reaching the height of the surrounding aspen (30-40 feet).

Based on current conditions in the project area and the desired condition in the Forest Plan, there is a need to improve aspen habitat in the project area. This would contribute to the Forest goal of a minimum of 92,000 acres of aspen habitat during the life of the Plan.

Activities that could improve aspen habitat include removal of pine through cutting or prescribed burning.

Meadow Communities

Objective 205 is to manage for 122,000 acres of prairie grassland and 3,600 acres of meadow during the life of the Plan. Restored acres will not be considered suitable for timber production (Forest Plan, page I-7).

[1] Forest Plan Objectives referenced in this document are defined in Appendix 2.

In the Moskee project area, there are approximately 1,200 acres of meadows. Most are located in drainage bottoms and may be several miles long but only 100-200 feet wide. Pine is encroaching on many of these meadows.

Based on current conditions in the project area and the desired condition in the Forest Plan, there is a need to reduce the areas where pine is encroaching on meadow communities in the project area. This would contribute to the Forest goal of maintaining 3,600 acres of meadow across the Forest during the life of the Plan.

Meadow communities could be maintained by removing small-diameter pine, removing merchantable pine that serves as a seed source, and burning to set back forest succession.

Forest Plan Goal 3

Goal 3 of the Forest Plan is to provide for sustained commodity uses in an environmentally acceptable manner (Forest Plan, pages I-13 through I-15).

> "Sustainable economic activity depends upon sustainable ecosystems… Congress has recognized the importance of sustainable commodity use in laws including the Multiple-Use, Sustained-Yield Act, the National Forest Management Act, the Organic Act…" (Forest Plan, page I-13)

The Moskee project can contribute toward meeting this goal by addressing needs related to production of timber.

Contribution to Forest ASQ

Objective 303 is to offer the following allowable sale quantity (ASQ) of timber on suitable and available timberlands in the next decade (Forest Plan, page I-14; Table 2).

Table 2: Allowable Sale Quantity from Suitable Lands (per-decade total)

Product	Million Cubic Feet	Million Board Feet
Sawtimber	181	838
Roundwood	21	NA
Total	**202**	**838**
"Suitable lands": Lands suitable for timber production		

The allowable sale quantity (ASQ) for the first decade was 838 MMBF of sawtimber. The actual Forest offer for this period was well below that figure. Fiscal Year 2007 begins the second decade of implementation of the Revised Forest Plan. Direction for the second decade is that timber harvest levels should not exceed 838 MMBF (181 MMCF). (USFS 2005a; Forest Plan, Guideline 2402).

Based on the desired condition in the Forest Plan, there is a need to provide outputs to contribute to the Forest ASQ.

Cutting merchantable trees in the project area would contribute to the Forest Plan ASQ.

Forest Plan Goal 10

Goal 10 of the BHNF is to establish and maintain a mosaic of vegetation conditions to reduce occurrences of stand-replacing fire and insect and disease events, and facilitate insect and disease management and firefighting capability (Forest Plan, page I-35). The Moskee project can contribute toward meeting Goal 10 by addressing needs related to wildfire hazard and risk of

mountain pine beetle infestation.

Wildland Fire Hazard

Objective 10-01 is to manage for 50 to 75 percent moderate to low fire hazard in the wildland-urban interface (WUI) and to manage the remainder of the Forest for 50 percent moderate to low fire hazard (Forest Plan, pages I-35 through I-36). There is no WUI in the Moskee project area according to the National Fire Plan definition (1.5 miles from an At-Risk Community with a Community Wildfire Plan in place; National Fire Plan 2000). Approximately 57 percent of NFS lands in the project area have moderate to low fire hazard. This meets Objective 10-01. Vegetation modeling predicts that the percentage of the NFS lands with moderate to low fire hazard would decrease to 40 percent within 15 years, and to 25 percent within 30 years.

Based on developing conditions in the project area and the desired condition in the Forest Plan, there is a need to change conditions expected to lead to increased hazard of wildland fire in the project area.

Activities that could reduce fire hazard include thinning of dense pine stands, regeneration harvest to modify the age structure across the project area, prescribed fire, mechanical fuels reduction, and removal of pine from hardwood and meadow communities.

Mountain Pine Beetle Infestation Risk

Objective 10-07 is to reduce acreage of ponderosa pine stands that are at medium or high risk of mountain pine beetle infestation where beetle outbreaks could put management objectives at risk (Forest Plan, page I-36).

In the Moskee project area, the combined area at medium or high risk of mountain pine beetle infestation is 13,615 acres, or 75 percent of the pine cover type on NFS lands. Management objectives, including timber production and wildfire suppression, could be threatened by high levels of beetle infestation.

Based on current conditions in the project area and the desired condition in the Forest Plan, there is a need to reduce the risk of mountain pine beetle infestation in the project area.

Activities that could reduce the risk of pine beetle infestation include thinning of dense pine stands and regeneration harvest to modify age class distribution across the project area.

Forest Plan Goal 4.1-401 and Guideline 9202; FSM 7700 – Transportation System

Forest Service Manual (FSM) policy is to determine and provide the minimum forest transportation system that best serves current and anticipated management objectives and public uses of NFS lands, as identified in the appropriate land and resource management plans (FSM 1920). Management direction is to:

> Emphasize maintenance and reconstruction of classified [FSR] roads to meet road management objectives… Unclassified [unauthorized] roads will be closed and made inaccessible where funding permits unless they are made part of the authorized forest road system as provided for in this policy… (FSM 7703.2)

There are many unplanned, unauthorized, and unclassified travelways on NFS lands that are high-priority for decommissioning. In addition, Forest Plan direction is to reduce the long-term impact of roads on soils (Forest Plan, page II-80) and emphasize non-motorized recreational opportunities in MA 4.1 (Forest Plan, page III-48). The Moskee project can contribute toward

meeting this direction by addressing needs related to unnecessary or unauthorized roads and, in MA 4.1, off-road motorized travel.

Of the approximately 151 miles of road in the project area, 120 miles are NFS roads and 31 miles are unauthorized roads. NFS lands in the project area are open to off-road motorized travel.

Based on current conditions in the project area and FSM and Forest Plan direction, there is a need to (1) reduce the total miles of road in the project area to provide the minimum transportation system, (2) decommission unclassified roads in the project area to reduce long-term effects on soils, and (3) provide non-motorized recreational opportunities in MA 4.1.

Activities that could reduce total road miles and long-term effects on soils in the project area include decommissioning unauthorized roads and unneeded NFS roads, or converting unauthorized roads for which there is a long-term need to NFS roads or trails. Implementation of an area closure in MA 4.1 would increase non-motorized recreational opportunities.

Purpose and Need Summary

In summary, the purpose of and need for action in the Moskee project area is to move the project area towards Forest Plan desired conditions by diversifying forest structure, maintaining or enhancing hardwood and meadow communities, providing for sustained commodity uses, reducing fire hazard and risk of mountain pine beetle infestation, decreasing unauthorized roads, and providing non-motorized recreational opportunities.

Issues

Public Involvement

Public involvement in this project began in January 2006 when the Moskee project was listed on the Black Hills National Forest's Quarterly Schedule of Proposed Actions. Public scoping began on August 26, 2006, when the project description and request for comments were mailed to 85 individuals, organizations, and agencies. See page 150 for a list of those contacted during scoping.

Bearlodge Ranger District received letters from six parties in response to scoping:

- A. Everett, Black Hills Forest Resource Association, Rapid City, South Dakota
- K. Dennis, Crook County Land use Planning and Zoning Commission, Sundance, Wyoming
- J. Batt, Pope and Talbot Inc., Spearfish, South Dakota
- K. Arcorn, Rosebud Sioux Tribe, Rosebud, South Dakota
- V. Stetler, Wyoming Game and Fish Department, Cheyenne, Wyoming
- J. Hein, Wyoming State Forestry Division, Cheyenne, Wyoming

Tribal Consultation

The 1992 amendments to the National Historic Preservation Act (1966) require the Forest Service to consult with Tribes (defined as federally recognized Tribes and Alaska Native Corporations) regarding potential affects on historic and archaeological sites. Executive Orders 13084 and 13175 also require that Federal agencies consult with Tribes during planning activities.

Black Hills National Forest and Tribal representatives meet twice a year to discuss new and ongoing concerns, partnership opportunities, and issues that may affect high-profile sacred and spiritual sites. Forest representatives also meet with Tribal Historic Preservation Officers (THPOs) yearly to discuss potential projects that require the NHPA Section 106 consultation process. For the Moskee project, Tribes were sent a scoping letter requesting information regarding known sacred or spiritual sites/landscapes and gathering areas. The Forest Service received a letter in response from the Rosebud Sioux Tribe stating that, at this time, there were no concerns with this project.

Identification of Significant Issues

The ID team identified issues relating to the proposed action based on input from other agencies, organizations, landowners, and other members of the public, as well as Forest Service resource specialists. The ID team separated the issues into two groups as directed by the Council on Environmental Quality (CEQ) regulations (40 CFR 1500.4(g) and 1501.7): significant and non-significant issues. The CEQ regulations for implementing NEPA require 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…" Significant issues are defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues are 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) not related to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. A list of non-significant issues and the reasons they were categorized as non-significant may be found in the project record.

To be considered a significant issue, a public comment must be:

- Specific to the Moskee project area, and
- Relevant to the Moskee project proposed action, showing a disagreement with the proposed action that cannot be resolved except through the development of an alternative to the proposed action.

Once a significant issue is identified, measures are selected to compare how alternatives respond to it. Where possible, measures are quantifiable and are chosen with regard to predictability, responsiveness to the issue, and link to the cause-and-effect relationship of the issue. A measure describes how the alternatives affect resources. Monitoring and mitigation of the anticipated environmental effects of the project were also designed to respond to significant issues.

The following significant issues were identified.

1. ***Treatment of more of the project area could further reduce wildfire hazard and mountain pine beetle infestation risk and improve structural diversity.***

   Measure: Acres of treatment proposed.

2. ***Uneven-age management could enhance stand diversity and value for a variety of wildlife species.***

   Measure: Acres of uneven-age management proposed.

3. ***Additional reduction of ponderosa pine encroachment into meadows, riparian areas, and hardwood stands would enhance these species-rich habitats and increase their ability to***

resist fire.

Measure: Acres of pine encroachment treated.

4. ***Reburning forested areas recently treated with prescribed fire would further improve condition class and increase wildfire resistance.***

   Measure: Acres of recent burns proposed for reburning.

5. ***Wildfire hazard could be reduced in pine stands by reducing understory density and continuity and retaining large trees.***

   Measure: Acreage treated to produce stands of large trees with limited understory.

Decisions to be Made

The scope of the analysis and the project decisions are limited to the Moskee project area. The EA provides the Deciding Official (the Bearlodge District Ranger) with the information needed to make the following decisions regarding the Moskee project:

1. Selection of the alternative that would best move the Moskee project area towards the desired condition per Forest Plan direction and address the needs and issues identified for this project.
2. Whether additional mitigation measures and monitoring requirements outside the Forest Plan would be applied to the proposed activities.

If an action alternative is selected and the project is not appealed, project implementation could begin in late 2007 and would be expected to include multiple timber sales and post-sale activities.

CHAPTER 2—PROPOSED ACTION AND ALTERNATIVES

Introduction

This chapter describes the proposed action, the no action alternative, two action alternatives, and several alternatives not analyzed in detail. Site-specific design criteria and monitoring items are also described. Finally, alternatives are compared in terms of their environmental effects and achievement of Forest Plan goals and objectives.

Alternative Development Process

The ID team developed the proposed action (Alternative 2) to address needs and take advantage of opportunities identified through comparison of existing conditions and Forest Plan direction (see Chapter 1). The team developed alternatives to the proposed action in response to concerns and ideas raised during public scoping. Alternative 3 was developed to respond to the significant issues by increasing the percentage of the project area treated with timber harvest and prescribed fire, incorporating uneven-age management and reburning, and removing encroaching pine from aspen stands and meadows. The team based Alternative 4 on Alternative 3, but responds to issues by adding more uneven-age management, decreasing burning, and retaining more mature, open pine stands with limited understory pine.

Proposed Action and Alternatives Analyzed in Detail

No Action (Alternative 1)

Alternative 1 is the no new Federal action alternative under which conditions in the project area will continue to progress naturally. It serves as a baseline for comparison of the effects of the action alternatives.

Alternative 1 represents the existing condition. Under Alternative 1, ongoing management activities would continue. No new activities would occur at this time. Changes might result from current management direction (such as road maintenance), natural processes, or other management decisions in the future. This alternative provides a foundation for describing and comparing the magnitude of environmental changes associated with the action alternatives against those changes that would be expected to occur if no new actions took place at this time.

Proposed Action (Alternative 2)

The proposed action includes activities to address the resource concerns/needs identified for the project area (see Chapter 1). Implementation of these activities would be expected to move the project area toward desired Forest Plan conditions as summarized in Table 4 (page 26). Alternative 2 is summarized in Table 3 (page 24) and displayed on Maps 10, 11, and 16 in Appendix 1. The following actions are proposed.

If an action alternative is implemented, actual amounts of activities accomplished on the ground (measured in acres, miles, or board feet) may differ slightly from these estimates. Any variance would be in accordance with Forest Plan Standards and Guidelines and any applicable laws and regulations, and would be documented in the project file.

Commercial Timber Harvest

Proposed commercial treatments include commercial thinning, shelterwood seedcut, overstory removal, and combinations of these treatments.

Commercial Thinning. Thinning of mature trees in pine stands would take place on 3,272 acres. Residual basal area would average 50 square feet per acre on 1,288 acres, and 60 square feet per acre on 1,984 acres. This equals an average of about 28 to 32 feet between trees 14 inches DBH[2], but would vary within stands to provide variety in habitat and scenery. Smaller, unhealthy, poorly formed, and decadent trees would be cut to increase growth of remaining trees. The primary objective of this treatment is production of wood fiber and increased growth and vigor of the remaining trees to reduce the risk of loss to pathogens. Another objective is to raise canopy height, which would remove ladder fuels and decrease fire severity and rate of spread.

Shelterwood Seedcut. This silvicultural treatment removes some of the mature trees to open the stand and allow young trees to regenerate and become established. This treatment would be used on 652 acres and would result in stands with about 45 feet between trees averaging 16 inches DBH. This treatment would retain enough large trees to provide a seed source and future large-diameter snags. The primary objective is establishment of pine regeneration.

Overstory Removal. Where seedlings and saplings have become established, most of the mature trees would be cut to allow maximum growth of the new stand. This treatment would occur on 125 acres.

Shelterwood Seedcut/Overstory Removal. This treatment would take place on 306 acres in stands with patches of pine regeneration. The majority of the stand would be treated with shelterwood seedcut, but in areas with sufficient regeneration, overstory removal would take place.

Overstory Removal/Shelterwood Seedcut. This treatment would take place on 1,032 acres. The majority of each stand would be treated with overstory removal, with seedcut taking place where pine regeneration is insufficient.

Shaded Fuel Breaks. Pine stands with high tree density and ladder fuels would be mechanically treated to reduce fuel loading and continuity. This treatment would be used on 342 acres along sections of NFSRs 807.2 (Deer Creek) and 875.1 (Grand Canyon) to create a fuel break 200 to 400 feet wide. The overstory would be thinned to 10-20 square feet of basal area per acre and all understory pine would be cut. All other material such as slash, pine reproduction, and other woody debris would either be chipped or piled and burned. The fuel breaks are intended to reduce the potential for wildfire growth and provide defensible access and egress routes. This treatment would also occur in some of the interface zone[3] along the private lands in Grand Canyon and Lost Canyon. Fuel breaks would exclude non-pine stands and inoperable areas, and would retain fire-resistant hardwoods such as aspen and birch.

[2] Diameter at breast height (4.5 feet above the ground on the uphill side of the tree).
[3] Within 300 feet of private land (USFS 2006)

Non-commercial Vegetation Management

Precommercial Thinning. Saplings would be thinned to improve growth on 1,464 acres. This treatment would reduce stand density through selective retention of the best-formed, healthiest trees within the spacing guidelines. Primary goals are to improve growth, preclude stand stagnation, and reduce continuity of fuels. Slash in excess of fuel guidelines would be piled and burned, chipped, or removed to reduce fire danger and pathogen habitat.

Prescribed Burning. Broadcast burning would be used to reduce fuels on 3,911 acres. The purpose of the treatment is to consume fuels on the ground and kill small trees and lower branches on larger trees, reducing the chance of a wildfire reaching the tree crowns. When conditions allow, burning would take place in spring rather than fall due to the beneficial effects of higher soil moisture present in spring.

Other Proposed Actions

Decommissioning of 25 miles of unauthorized roads and 0.5 mile of NFS road (804.1H) would take place as funding and opportunity allow. Decommissioning would consist of permanently closing roads through various means but may not include removal of any existing road template.

Conversion of 0.1 mile of road (another section of 804.1H) to a designated snowmobile trail would take place.

Closure of MA 4.1 to use of motorized vehicles off roads.

Connected Actions

The following activities would take place to facilitate the proposed actions described above.

Transportation System

Construction of approximately 6.0 miles of new road would be necessary to carry out proposed vegetation management. The new roads would be stored (closed with barriers) after the project is complete.

Reconstruction of approximately 67.8 miles of existing NFSRs would take place. Reconstruction includes both road improvement (adding gravel, repairing rolling dips, etc.) and road realignment (moving the road template). Sections of NFSRs 808.1D and 808.2B would be realigned. These roads are shown on Maps 11 and 16 in Appendix 1. About 0.9 mile of NFSR 808.1D is currently in a drainage bottom and would be moved approximately one-tenth of a mile to the north and out of the drainage. The southernmost 0.25 mile of NFSR 808.2B would be moved east out of a drainage bottom. The original route of these roads would be decommissioned.

Pre-use maintenance would take place on six miles of roads needing minor improvements or repair. Examples of pre-use maintenance include blading to remove ruts or addition of gravel in wet spots.

Acquisition of easements on 3.7 miles of road. If an easement is acquired on road 885.1, construction would be reduced by 1.1 miles. Roads and easements are shown on Maps 3, 11, and 16 in Appendix 1.

Release and Weed

Cull trees would be cut following commercial harvest on 4,525 acres.

Treatment of Activity Fuels

Depending on individual site characteristics, commercial harvest may use whole-tree yarding. This method results in concentrations of tree tops and limbs at log landings. These slash piles would generally be burned, but may also be chipped. The resulting disturbed area would be scarified, seeded, and treated for noxious weed infestation if necessary.

Conventional yarding systems can result in tops and branches spread across a site rather than concentrated at a log landing. Where resulting fuel loading would exceed Forest Plan direction, fuels would be crushed, burned, or otherwise reduced.

Prescribed Fire Control Line Rehabilitation

Lines constructed for control of prescribed fires would be rehabilitated to prevent erosion and weed infestation. Methods may include construction of water bars, replacement of sod and brush, and seeding.

Noxious Weed Control

Where proposed actions result in spread of noxious weeds, control treatments would be applied as necessary.

Design Criteria and Mitigation

Forest Plan Standards and Guidelines, Regional Watershed Conservation Practices (WCPs, Forest Service Handbook 2509.25), and other management requirements apply to these activities. These requirements are listed in Appendix 2 and repeated here only if clarification is required. Site-specific design criteria applicable to activities proposed under Alternative 2 include the following.

Revegetation of Disturbed Soil

1. Native vegetation would be retained to the maximum extent possible during proposed activities. Disturbed soil would be revegetated in a manner that optimizes plant establishment on the site. Revegetation may include topsoil replacement, planting, seeding, fertilization, and placement of weed-free mulch as necessary. Revegetation would be initiated as soon as possible, generally not to exceed 6 months, after termination of ground-disturbing activities. All disturbed soils would be revegetated with native species when available using seed mixtures that are free of noxious weeds. On areas needing the immediate establishment of vegetation, non-native, non-aggressive annuals, non-aggressive perennials, or sterile perennials may be used until native perennials become established.
2. Timber sale roads would be seeded after construction but before timber harvest if any part of the gap between construction and harvest would occur between April and October. This may be accomplished under the road contract. If necessary, seeding would again occur after use of the road is complete. Seeding may be delayed until after completion of harvest if the gap between construction and harvest would be of short duration and/or hydrology, soils, engineering, and noxious weed specialists determine after field review that a delay would be acceptable.
3. Slash pile sites would be ripped and reseeded with an approved seed mix as soon as possible following pile disposal (burning, chipping, etc.).

Rare Species

4. To conserve the sole known occurrence of Baker's mariposa lily in Wyoming and South Dakota, logs would be hauled from stands 012108-50 and 012108-78 only to NFSR 805.3 via NFSR 805.3A. Only the first 1.2 miles of 805.3A as measured from its intersection with 805.3 would be reconstructed. No reconstruction would take place on the remainder of 805.3A. No fireline construction would take place in this habitat, displayed in the Moskee Project Analysis File (Section J001). Stands 012108-34 and 012108-38 would be accessed only from NFSR 805.3 and/or the first 0.2 miles of NFSR 805.3B from its intersection with 805.3. NFSRs 805.3B, 805.3E, and 805.3D would not be used, and logs would not be forwarded to these roads.

5. To reduce the potential for negative effects on habitat suitable for sensitive plant species, activities that may occur adjacent to stands proposed for treatment (e.g., log landing, skidding, construction of fire control lines) would take place outside suitable habitat if possible. If not possible, locations for these activities would be designated after consultation with a botanist. Stands proposed for treatment that are adjacent to suitable habitat are listed below and displayed in Section J001 of the Moskee Project Analysis File. Bold type indicates commercial timber harvest is proposed.

   011703-**16, 29, 44, 58, 90, 132, 140,** 145
   011704-**9, 11, 29, 32**
   011801-**30, 70, 90, 91**
   011806-50, **54,** 55, **59, 68,** 85
   011901-**17**
   011906-27, 83, 122
   012108-**34, 38, 50, 91**

   Road work proposed in or adjacent to suitable sensitive plant habitat would be coordinated with a botanist. Road work proposed in this habitat includes reconstruction of NFSR 808.1J and a section of 808.1A, and decommissioning of U720040. Road work proposed adjacent to suitable habitat includes construction of road N-8, reconstruction of NFSRs 808.1A, 808.2B, and 820.1, and decommissioning of roads U710085, U740078, and U740119. Maps of affected areas are in Section J001 of the Analysis File.

6. The documented land snail colony (site 143, Frest and Johannes 2002) would be protected. Proposed vegetation treatments would remain 150 feet from the colony or on the other side of NFSR 875, whichever is less. The fence around the site would be protected during all proposed activities. Disturbance of any newly discovered colonies of land snails would be avoided. The district wildlife biologist would determine a buffer area around newly discovered colonies based on site-specific conditions.

7. Any new goshawk nests found during project implementation would be protected in accordance with Forest Plan direction. Any other raptor nests found during project layout or implementation would be evaluated by a wildlife biologist on a site-specific basis to determine if special requirements are warranted to protect site integrity.

Protection of Pine Regeneration

8. In stands or portions of stands treated with overstory removal harvest, existing pine regeneration would be protected during all phases of harvest operations. Timber in these

stands would be felled and skidded with mechanical equipment. In addition, contract provisions regarding protection of pine regeneration would be included in the timber sale contract. Skid trails within these stands would be at least 100 feet apart and their location approved by the sale administrator prior to commencement of logging.

Heritage Resources

9. Known heritage sites would be protected. No activities would take place within 100 feet of these sites. Heritage sites would be avoided during all proposed activities. Leaders of proposed projects would review heritage maps and implement mitigation measures for sites listed in the heritage resources file.
10. If previously unknown heritage resources are discovered during project activities, project staff would stop ground-disturbing actions and notify the district archeologist before activities are resumed.
11. Heritage resource inventory would be completed in proposed burn units prior to implementation per USFS Agreement No. 01-MU-11020000-015 (Programmatic Agreement Among the Advisory Council on Historic Preservation, the Colorado, Wyoming, South Dakota, Nebraska, and Kansas SHPOs, and the USDA Forest Service Rocky Mountain Region Regarding Implementation of the Prescribed Fire Program).

Improvements

12. All Forest Service-authorized improvements, such as maintained fences, property corners, and water developments, would be shown as protected improvements on timber sale area maps and protected during all management activities.
13. Electrical lines along NFSR 805.1 may have aboveground junction boxes requiring protection. Activities in this area would be coordinated with Powder River Energy Corporation.

Noxious Weeds

14. Noxious weed control activities would take place prior to ground-disturbing activities, when funded, to reduce weed spread and establishment.
15. Review of the area for noxious weed infestations would continue during proposed activities. If new noxious weed infestations that could be spread by proposed activities are found during implementation, actions to minimize spread would be taken.
16. Prescribed burn plans would address control of known noxious weed infestations within burn blocks.
17. District staff responsible for the noxious weed program would, in coordination with the project engineer, inspect gravel pits for noxious weed infestation before transport and use of gravel and other material. Infestations would be treated to prevent spread.
18. District staff responsible for the noxious weed program would inspect stockpiled gravel annually for weed infestation in coordination with the project engineer.
19. Contracts and permits issued as part of this project would include measures to limit spread of noxious weeds. Heavy equipment used for timber harvest would be washed before entering the timber sale area if the area it previously operated in is unknown or documented to be

infested with noxious weeds. Where data are unavailable, noxious weed infestations would be identified by district staff and designated on sale area maps for any timber sales associated with this project.

20. See also Noxious Weed Prevention Practices in Appendix 2.

Recreation and Public Safety

21. Appropriate signing or other cautionary measures would be implemented in conjunction with all management activities to ensure public safety. Implementation of these measures would be the responsibility of the person initiating the action (e.g., logging contractor, prescribed fire manager).
22. To prevent the loss of winter recreation activities and provide for safety of winter visitors, wheeled vehicles would be prohibited from using designated snowmobile trails from December 15 to March 31. Designated snowmobile trails are those that will be identified for the 2007-2008 snowmobile season.
23. If winter log hauling takes place, snowmobiles would be restricted to designated trails. Cautionary signs would be installed where snowmobile trails cross routes used by wheeled vehicles.

Range

24. Managers of vegetation treatment projects would consult with district range managers to ensure alteration of natural barriers does not allow livestock to circumvent fences.
25. All pasture gates would be identified on timber sale area maps and kept closed during the grazing season (generally June through October).
26. If log hauling or movement of heavy equipment related to the proposed timber harvest causes damage to cattleguards, the timber purchaser would be responsible for repair.
27. Landings and slash piles would be located outside grasslands, meadows, and riparian areas to protect vegetation and reduce loss of available forage unless approved by the district range manager, botanist, and hydrologist.
28. Road work would be coordinated with grazing permit holders.

Snags

29. Snags would be cut only for safety reasons, including when necessary to provide safe passage on roads, skid trails, fire control lines, and at log landings.
30. Where possible, any snags cut as safety hazards would be left on site rather than salvaged or skidded to landings. Timber sale contract provisions would be used to protect snags.
31. To ensure provision of down woody material, 50 or more linear feet per acre of logs averaging at least 10 inches in diameter would be left on site following all commercial treatments.

Soil and Water

32. Heavy equipment would not enter the water influence zone along perennial or intermittent streams (100 feet on either side of the stream) (Standard 1301 and WCP management

measure 3) except to conduct road work at designated locations. Proposed commercial and/or non-commercial treatments may overlap water influence zones at locations identified in the project file. If harvest units are laid out within water influence zones at these sites, logs would be removed using the method that results in the least ground disturbance, depending on site-specific conditions. Prescribed fire may occur in water influence zones but should not include direct ignition.

33. Heavy equipment use on areas where Vanocker soils present a severe erosion hazard, such as below rock outcrops in soil map unit 155 and on ridges and sideslopes in map unit 201, would be avoided consistent with WCPH Management Measure 9, Design Criteria (e). Affected stands include 011701-35, 011703-102, 011703-191, 011801-30, 011801-70, 011801-91, 011803-1, 011803-27, 011804-39, 011805-3, 011901-09, 011901-14, 011901-23, and 012007-5. These stands are displayed in the Analysis File, Section J012.
34. Cable logging systems that lift one end of the log would be used on sustained slopes steeper than 40 percent and on moderately to severely burned slopes greater than 30 percent consistent with WCPH Management Measure 9, Design Criteria (g).
35. Roads, landings, skid trails, and other concentrated use sites would be restricted to designated sites consistent with WCPH Management Measure 12/Design Criteria (a).
36. Heavy equipment used 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).
37. On soil map units with limited organic material, shelterwood seedcut and group selection harvest within Paunsaugunt soil areas of the specified map units would be conducted using conventional harvest systems that retain the slash. Affected areas are shown in Section J002 of the Moskee Project Analysis File. Soils are shown on Map 4 in Appendix 1. If whole-tree harvesting is used, fine slash (less than three inches in diameter) would be returned to the site in quantities identified in Forest Plan Standard 1102/Guideline(a).
38. Prescribed burns would be conducted to minimize the residence time on the soil while meeting burn objectives in accordance with WCPH Management Measure 13/Design Criteria (c).
39. Portions of stands 011902-56 and 011902-57 where revegetation following past burns is incomplete would be avoided during timber harvest.
40. No timber harvest would take place within 100 feet of the spring and pond in stand 011808-40.
41. On other areas to be harvested meeting the slope stability survey criteria, in contiguous areas or concentrations of areas exceeding one acre, at least 25 to 33 percent of the canopy cover would be retained. These areas are mapped in Section J004 of the Moskee Project Analysis File.
42. See Watershed Conservation Practices in Appendix 2.

Travel Management

43. While proposed projects are taking place, all gates that would normally be closed during big game hunting seasons would be kept closed during these seasons and one week before the

seasons except to allow administrative traffic. Gates would be closed again immediately after the administrative traffic passes.

44. Timber sale units would be laid out to facilitate existing road restrictions (for example, trees around gates and other barriers would be left uncut to maintain obstructions and discourage driving around the gate or barrier).
45. All newly constructed roads would be closed following construction until needed for timber sale or related activities and stored on completion of use.

Scenery

46. Layout and marking of timber sale units would comply with forest-wide marking guides in effect at the time of implementation.

Dust Control

47. Dust control, if necessary, may be done with water, magnesium chloride, calcium chloride, or equivalent.

Alternative 3

Alternative 3 was developed to respond to the issues identified starting on page 7. This alternative would take advantage of additional treatment opportunities (Issue 1), create uneven-age stand structure (Issue 2), reduce the amount of pine encroaching aspen stands and meadows (Issue 3), and reburning previously burned areas (Issue 4). Alternative 3 is summarized in Table 3 (page 24) and displayed on Maps 12, 13, and 16 in Appendix 1. The following actions are proposed.

Commercial Timber Harvest

Proposed commercial treatments include commercial thinning, shelterwood seedcut, overstory removal, combinations of shelterwood seedcut and overstory removal, shaded fuel breaks, and group selection. Except for group selection, these silvicultural methods are described on page 10. Group selection, an uneven-age method, is described below.

Commercial Thinning: Thinning to 50 square feet of basal area per acre on 1,195 acres; to 60 square feet on 1,948 acres.

Shelterwood Seedcut: 685 acres.

Overstory Removal: 240 acres.

Shelterwood Seedcut/Overstory Removal: 1,010 acres.

Overstory Removal/Shelterwood Seedcut: 1,507 acres.

Shaded Fuel Breaks: 342 acres.

Group Selection. This treatment is proposed on 857 acres. Group selection would begin the process of creating uneven-age stand structure. A third of the acreage (286 acres) would be regenerated in three- to five-acre patches. During the next harvest entry (15-20 years in the future), another third of the acreage would be treated with group selections. After the third entry, the stands would have developed uneven-age structure. The future entries would be subject to

separate NEPA analysis. During this entry, the remaining 571 acres between the groups would be commercially thinned to control stand density and subsequent insect and disease susceptibility.

Non-commercial Vegetation Management

Precommercial thinning and prescribed burning are described on page 11.

Precommercial Thinning: 2,757 acres.

Prescribed Burning (New and Maintenance): 6,348 acres, including 3,528 acres of new burns and 2,820 acres of maintenance burning. Maintenance burning would take place in stands burned under the Adams and Bald-Carnegie Prescribed Burn projects, which took place from 2002 through 2005. These burns reduced fire hazard and increased the probability that wildfires would remain on the ground rather than reaching into the treetops, where they are harder to control. The intent of reburning is to maintain these characteristics. Because fuels have already been altered, maintenance burning would have less chance of escape than the first burning entry. Reburning would also convert the burned areas to Condition Class[4] 1 by reestablishing the return interval within the historical range.

Pine Encroachment. Encroaching pine would be cut from 1,178 acres of meadows and draw bottoms. These areas are being overgrown by pine and would be restored to an open condition.

Pine from Aspen. Non-commercial pine would be cut on 1,000 acres of hardwoods (aspen/birch) being overgrown by conifers.

Other Proposed Actions

These activities are described starting on page 11.

Decommissioning of 26 miles of unauthorized roads and 0.5 mile of NFS road (804.1H).

Conversion of 0.1 mile of road (another section of 804.1H) to a designated snowmobile trail.

Closure of MA 4.1 to use of motorized vehicles off roads.

Connected Actions

The following activities would take place to facilitate the proposed actions described above. Descriptions start on page 11.

Transportation System

Road Construction: 5.0 miles.

Road Reconstruction: 75.1 miles.

Road Pre-use Maintenance: 5.7 miles.

Easements: 3.7 miles.

Release and Weed

Cull trees would be cut following commercial harvest on 3,875 acres.

[4]Condition class reflects the degree of departure from historical fire regimes. See page 119.

Treatment of Activity Fuels

See page 12.

Prescribed Fire Control Line Rehabilitation

See page 12.

Noxious Weed Control

Where proposed actions result in spread of noxious weeds, control treatments would be applied as necessary.

Design Criteria and Mitigation

Forest Plan Standards and Guidelines, Regional Watershed Conservation Practices (WCPs, Forest Service Handbook 2509.25), and other management requirements apply to these activities. These requirements are listed in Appendix 2 and repeated here only if clarification is required. Site-specific design criteria applicable to activities proposed under Alternative 3 include those listed for Alternative 2 (starting on page 12) with the following changes and additions.

Rare Species

5. To reduce the potential for negative effects on habitat suitable for sensitive plant species, features that may be located adjacent to stands proposed for treatment (e.g., log landings, skid trails, fire control lines) would not be placed in suitable habitat. Stands proposed for treatment that are adjacent to suitable habitat are listed below and displayed in Section J001 of the Moskee Project Analysis File. Bold type indicates commercial timber harvest is proposed.

   011703-13, **16, 29, 44, 58,** 60, 87, 90**,** 98, **132, 140,** 145
   011704-**9, 11, 29, 32, 45,** 69
   011801-29, **30, 70, 90, 91**
   011806-50, **54,** 55, **59, 68,** 85
   011901-**17,** 24
   011903-13, 14, 43
   011904-9, 19, 77
   011906-27, **83,** 122
   012007-**1**
   012108-29, **34, 38, 50, 78, 91,** 98

   Road work proposed in or adjacent to suitable sensitive plant habitat would be coordinated with a botanist. Road work proposed in this habitat includes reconstruction of NFSR 808.1J and a section of 808.1A, and decommissioning of U720040. Road work proposed adjacent to suitable habitat includes construction of road N-8, reconstruction of NFSRs 808.1A, 808.2B, and 820.1, and decommissioning of roads U710085, U740078, and U740119. Maps of affected areas are in Section J001 of the Analysis File.

Soil and Water

33. Heavy equipment use on areas where Vanocker soils present a severe erosion hazard, such as below rock outcrops in soil map unit 155 and on ridges and sideslopes in map unit 201, would be avoided consistent with WCPH Management Measure 9, Design Criteria (e).

Affected stands include 011701-35, 011703-102, 011703-191, 011801-30, 011801-70, 011801-91, 011803-1, 011803-27, 011804-39, 011805-3, 011901-09, 011901-14, 011901-23, 012007-5, 012007-6, and 012108-78. These stands are displayed in the Analysis File, Section J012.

Alternative 4

Alternative 4 was developed to respond to the issues identified starting on page 7. This alternative would move towards uneven-age stand structure on a greater area (Issue 2) while reducing fire hazard by retaining more stands of large trees and decreasing near-ground fuels (Issue 5). Alternative 4 is summarized in Table 3 (page 24) and displayed on Maps 14-16 in Appendix 1. The following actions are proposed.

Commercial Timber Harvest

Proposed commercial treatments include commercial thinning, shelterwood seedcut, combinations of shelterwood seedcut and overstory removal, group selection, and shaded fuel breaks. Most of these silvicultural methods are described on page 10. Group selection is described on page 17.

Commercial Thinning: Thinning to 50 square feet of basal area per acre on 1,195 acres; thinning to 60 square feet on 1,047 acres.

Shelterwood Seedcut: 685 acres.

Shelterwood Seedcut/Overstory Removal: 1,010 acres.

Overstory Removal/Shelterwood Seedcut: 1,156 acres.

Shaded Fuel Breaks: 342 acres.

Group Selection. 1,758 acres (586 acres of groups and 1,172 acres of thinning).

Non-commercial Vegetation Management

Precommercial thinning and prescribed burning are described on page 11. Reburning, understory mulching, pine encroachment, and pine from aspen are described starting on page 18.

Precommercial Thinning: 2,166 acres.

Prescribed Burning (New and Maintenance): 1,661 acres, including 1,457 acres of new burns and 204 acres of maintenance burning.

Understory Mulching. Pine trees less than nine inches in diameter would be mechanically chipped, mulched, or shredded on 1,259 acres. The purpose of the treatment is to create a stand structure featuring large overstory pine with little or no understory. Mechanical treatment would facilitate rapid drying of the fuels, which would in turn reduce conditions favorable for *Ips* (engraver beetle) buildup.

Pine Encroachment: 1,178 acres.

Pine from Aspen: 1,000 acres.

Other Proposed Actions

These activities are described starting on page 11.

Decommissioning of 26 miles of unauthorized roads and 0.5 mile of NFS road (804.1H).

Conversion of 0.1 mile of road (another section of 804.1H) to a designated snowmobile trail.

Closure of MA 4.1 to use of motorized vehicles off roads.

Connected Actions

The following activities would take place to facilitate the proposed actions described above. Descriptions start on page 11.

Transportation System

Road Construction: 5.0 miles.

Road Reconstruction: 74.1 miles.

Road Pre-use Maintenance: 5.7 miles.

Easements: 3.7 miles.

Release and Weed

Cull trees would be cut following commercial harvest on 3,251 acres.

Treatment of Activity Fuels

See page 12.

Prescribed Fire Control Line Rehabilitation

See page 12.

Noxious Weed Control

Where proposed actions result in spread of noxious weeds, control treatments would be applied as necessary.

Design Criteria and Mitigation

Forest Plan Standards and Guidelines, Regional Watershed Conservation Practices (WCPs, Forest Service Handbook 2509.25), and other management requirements apply to these activities. These requirements are listed in Appendix 2 and repeated here only if clarification is required. Site-specific design criteria applicable to activities proposed under Alternative 4 include those listed for Alternative 2 (starting on page 12) with the following changes and additions.

Rare Species

5. To reduce the potential for negative effects on habitat suitable for sensitive plant species, features that may be located adjacent to stands proposed for treatment (e.g., log landings, skid trails, fire control lines) would not be placed in suitable habitat. Stands proposed for treatment that are adjacent to suitable habitat are listed below and displayed in Section J001 of the Moskee Project Analysis File. Bold type indicates commercial timber harvest is proposed.

011703-13, **16, 29, 44, 58,** 60, **90, 132, 140**
011704-**9, 11, 29, 32, 45,** 69
011801-29, **30, 70, 90, 91**
011806-50, **54, 59, 68**
011901-**17,** 24
011903-14
011904-9, 46, 56
011906-**83**
012007-**1**
012108-29, **34, 38, 50, 78, 91,** 98

Road work proposed in or adjacent to suitable sensitive plant habitat would be coordinated with a botanist. Road work proposed in this habitat includes reconstruction of NFSR 808.1J and a section of 808.1A, and decommissioning of U720040. Road work proposed adjacent to suitable habitat includes construction of road N-8, reconstruction of NFSRs 808.1A, 808.2B, and 820.1, and decommissioning of roads U710085, U740076, and U740119. Maps of affected areas are in Section J001 of the Analysis File.

Soil and Water

33. Heavy equipment use on areas where Vanocker soils present a severe erosion hazard, such as below rock outcrops in soil map unit 155 and on ridges and sideslopes in map unit 201, would be avoided consistent with WCPH Management Measure 9, Design Criteria (e). Affected stands include 011701-35, 011703-102, 011703-191, 011801-30, 011801-70, 011801-91, 011803-1, 011803-27, 011804-39, 011805-3, 011901-09, 011901-14, 011901-23, 012007-5, 012007-6, and 012108-78. These stands are displayed in the Analysis File, Section J012.

Treatment Timing

The National Forest Management Act generally prohibits the harvest of stands before they reach their maximum growth rate (16 U.S.C. 1604(m)). Exceptions in this law allow the harvest of individual trees, or even parts or whole stands of trees, before this time to thin and improve timber stands and salvage damaged stands of trees (16 U.S.C. 1604(m1)). Further exceptions are allowed in order to achieve multiple-use objectives other than timber harvest (16 U.S.C. 1604(m2)).

Alternatives 2, 3, and 4 would harvest some stands before their maximum potential growth rate has been reached. These harvest treatments are consistent with the exceptions provided in 16 U.S.C. 1604(m2), and include the following: precommercial thinning, commercial thinning, pine encroachment cutting, pine removal from aspen, group selection, and fuel treatments. These treatments are proposed to meet the Forest Plan multiple-use objectives stated in Chapter 1.

Stewardship Contracting

Alternatives 2, 3, and 4 may result in opportunities for stewardship contracting, whereby goods are exchanged for services. These activities are a means for Federal agencies to contribute to the development of sustainable rural communities, restore and maintain healthy forest ecosystems, and provide a continuing source of local income and employment. Areas tentatively proposed for stewardship contracting are shown on Map 3 in Appendix 1.

Alternatives Considered but Eliminated from Detailed Analysis

The ID team considered the following alternatives but eliminated them from detailed analysis.

Fuel treatment in the areas burned by the Cement Fire and prescribed fire hot spots. Pope and Talbot, Inc., a forest products corporation, suggested fuel treatments in the area burned in July 2005 during the Cement Fire and in parts of recent prescribed burns with overstory mortality. The Cement Fire burned 61 acres in the project area. (The Moskee project area contains this part of the Cement Fire, but does not contain any of the old Cement forest management project area.) Approximately half of this is on private land, where burned trees were clearcut immediately after the fire. Of the remaining half on NFS lands, about 11 acres burned hot enough to kill most of the pine. Fuels in this area are currently composed mostly of heavy or large-diameter fuels and very little fines (needles). The Adams prescribed burn in 2005 killed patches of trees, mostly along NFSR 875. Mortality is considerably more scattered in the interior of the burn.

This alternative was eliminated from detailed consideration because fine fuels that could carry a fire are no longer present in these areas and the standing burned trees are therefore unlikely to spread fire. The burned trees are expected to gradually rot and fall, forming 1,000- and 10,000-hour fuels, which do not readily ignite. Rate of fire spread through heavy fuels is generally very low. There may be some short-range spotting and areas of intense fire, but suppression of wildfires in heavy, down fuels with bulldozers and sawyers is usually not difficult.

Conduct patch cuts and clearcuts to create early successional stages for the benefit of wildlife. The Wyoming Game and Fish Department (WGFD) suggested the use of clearcuts and patch cuts (clearcuts less than 10 acres in size) to move parts of the forest toward early-successional conditions. They also suggested that these openings be placed away from roads and areas frequently disturbed by humans. The project biologist did not identify a site-specific need for patch cuts or clearcuts, though group selections proposed under Alternatives 3 and 4 would result in similar small, transient openings. These would not be located on main roads or in other frequently disturbed areas, but some level of access would be required to remove the timber.

Aspen regeneration to improve wildlife habitat and provide natural fuel breaks. WGFD also suggested regeneration and enhancement of aspen. Alternatives 3 and 4 include enhancement actions (removal of non-commercial pine from 1,000 acres of aspen). Aspen regeneration was not analyzed in detail because the ID team did not identify specific decadent aspen stands in need of regeneration.

Focus project area treatments on moving each Management Area toward structural stage objectives. Black Hills Forest Resource Association suggested designing treatments in the project area to move forest-wide distribution of structural stages in MAs 4.1 and 5.1 toward Forest Plan objectives, particularly through regeneration harvest. Regeneration harvest is proposed under all action alternatives in the form of shelterwood seedcut and/or group selection. This alternative was not analyzed in detail because the driving force behind the project is the need to reduce mountain pine beetle infestation risk, produce timber, and maintain meadows and hardwood stands. As shown in Chapter 3 (page 71), all alternatives would contribute toward achievement of structural stage objectives except in creation of additional 4A, but this is a result of treatments designed to meet the purpose and need, including shelterwood seedcut.

Comparison of Alternatives Analyzed in Detail

Table 3 displays proposed activities by alternative. Table 4 displays how these activities would address the purpose of and need for this project, and Table 5 compares the response of the alternatives to the issues identified in Chapter 1.

Table 3: Comparison of Actions by Alternative

Vegetation treatments and other actions are defined on pages 10 through 17.

	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Commercial Timber Harvest (acres)				
Even-Aged Management				
Commercial Thinning to 50 BA	0	1,288	1,195	1,195
Commercial Thinning to 60 BA	0	1,984	1,948	1,047
Shelterwood Seedcut	0	652	685	685
Overstory Removal	0	125	240	0
Shelterwood Seedcut/Overstory Removal	0	306	1,010	1,010
Overstory Removal/Shelterwood Seedcut	0	1,032	1,507	1,156
Total Even-Aged Management	0	5,387	6,585	5,093
Uneven-Aged Management				
Group Selection (group size 2-5 acres)	0	0	286	586
Thin Between Groups	0	0	571	1,172
Total Uneven-Aged Management	0	0	857	1,758
Total Commercial Timber Harvest	**0**	**5,613**	**7,442**	**6,851**
Non-Commercial Vegetation Management (acres)				
Mechanical Fuel Treatments (shaded fuel breaks)	0	342	342	342
Precommercial Thinning	0	1,464	2,901	2,311
Prescribed Burning (New)	*0*	4,013	3,630	1,457
Prescribed Burning (Maintenance)	*0*	0	2,820	204
Pine Encroachment	0	0	1,178	1,178
Pine from Aspen	0	0	1,000	1,000
Understory Mulch	0	0	0	1,259
Total Acres Treated*	0	7,659	13,214	10,426
Other Proposed Actions				
Decommission Unauthorized Roads (miles)	0	25.0	26.0	26.0
Decommission NFS Roads (miles)	0	0.5	0.5	0.5

	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Convert Road to Snowmobile Trail (miles)	0	0.1	0.7	0.7
Area Closure (acres closed)	0	5,161	5,161	5,161
Connected Actions				
Road Construction (miles)	0	6.0	5.0	5.0
Road Reconstruction (miles)	0	67.8	75.1	74.1
Road Pre-use Maintenance (miles)		6.0	5.7	5.7
Weed and Release (acres)	0	4,525	3,875	3,251
Noxious Weed Control	0	As needed	As needed	As needed

*Total acres treated is less than the sum of individual treatments because some activities overlap.

Monitoring

The Forest Service would monitor implementation of Alternatives 2, 3, and 4. The timber sale administrator or other contract administrators would complete some of the project implementation monitoring as part of standard contract administration duties. Other resource specialists would be involved in monitoring of specific measures relating to their particular resource area. Monitoring items are listed below.

- The district archeologist would monitor known heritage sites eligible or potentially eligible to the National Register of Historic Places before and after project implementation.
- Prescribed fire managers would establish photo points in prescribed burn units to compare pre- and post-treatment conditions and document fire behavior during implementation.
- Fuels staff would evaluate effectiveness of fuel treatments in reducing fuel loading.
- Project managers would monitor revegetation of disturbed and burned areas to determine need for additional measures and noxious weed control.
- Wildlife staff would monitor the Frest snail colony to determine effectiveness of protective measures and need for any further measures.
- Wildlife staff would monitor known and suspected goshawk nests annually for nesting activity.
- If funds are available, engineering and hydrology/soils specialists would monitor effectiveness of erosion control measures (seeding, water bars, etc.) one and three years following installation.
- If funds are available, hydrology/soils staff would monitor soil compaction at a sample of timber sale landings and harvest units.
- Timber sale administrators and hydrology/soils specialists would monitor application and effectiveness of Best Management Practices.
- The district planning team would monitor project implementation following completion of activities.

Table 4. Response to Purpose and Need by Alternative

Needs are described starting on page 3.

Need	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Diversify forest structure	No immediate change	Generally would increase younger structural stages and decrease dense, mature forest	Moderate increase in younger structural stages, largest decrease in dense, mature forest	Largest increase in younger structural stages, moderate decrease in dense, mature forest
Maintain or enhance hardwood communities	Encroachment of pine in aspen stands would continue.		Pine would be removed from 1,000 acres of aspen.	
Maintain or enhance meadow communities	Encroachment of pine in meadows would continue.		Pine would be removed from 1,178 acres of meadow.	
Contribute to Forest allowable sale quantity	No contribution at this time	20.6 million board feet (MMBF)	28.2 MMBF	27.2 MMBF
Reduce wildland fire hazard *Percent change in fire hazard (project area NFS acres)*	No immediate change	Very High: -55% High: -45% Medium: +6% Low: +67%	Very High: -58% High: -62% Medium: -17% Low: +106%	Very High: -58% High: -63% Medium: -23% Low: +113%
Reduce mountain pine beetle infestation risk *Percent change in infestation risk (project area NFS pine acres)*	No immediate change	High: -57% Medium: +43% Low: +257%	High: -61% Medium: +42% Low: +356%	High: -58% Medium: +44% Low: +267%
Provide the minimum transportation system	151 miles of road in the project area	129.3 miles of road in the project area	127.3 miles of road in the project area	
Decommission unclassified roads	No decommissioning	25.0 miles of unauthorized roads would be decommissioned	26.0 miles of unauthorized roads would be decommissioned	
Provide non-motorized recreational opportunities in MA 4.1	MA 4.1 would remain open to use of motorized vehicles off roads	MA 4.1 would be closed to use of motorized vehicles off roads		

Table 5. Response to Issues by Alternative

Issue and Measure	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Issue: Treatment of more of the project area could further reduce wildfire hazard and mountain pine beetle infestation risk and improve structural diversity. *Measure: Acres of treatment proposed*	0	7,659 acres (including 5,613 acres mechanical treatment)	13,214 acres (including 9,846 acres mechanical treatment)	10,426 acres (including 10,508 acres mechanical treatment)
Issue: Uneven-age management could enhance stand diversity and value for a variety of wildlife species. *Measure: Acres of uneven-age management proposed*	0	0	857 acres	1,758 acres
Issue: Additional reduction of ponderosa pine encroachment into meadows, riparian areas, and hardwood stands would enhance these species-rich habitats and increase their ability to resist fire. *Measure: Acres of pine encroachment treated*	0	0	2,178 acres	2,178 acres
Issue: Reburning forested areas recently treated with prescribed fire would further improve condition class and increase wildfire resistance. *Acres of recent burns proposed for reburning*	0	0	2,820 acres	204 acres
Wildfire hazard could be reduced in pine stands by reducing understory density and continuity and retaining large, older trees. *Acreage treated to produce open stands of large, older trees with limited understory (SS 4A + burn or mulch)*	0	3,199 acres	4,771 acres	2,132 acres

CHAPTER 3—DIRECT/INDIRECT AND CUMULATIVE EFFECTS

Introduction

This section forms the scientific and analytical basis for the comparison of the potential environmental effects of the proposed action and 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 Forest Plan Standards, Guidelines and Objectives
- Compliance with federal and state laws and regulations

The Forest Plan and Phase 2 Amendment FEISs 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 forest environment. The projects and effects described in this EA are within the scope of those anticipated by the FEISs and are not repeated here. This EA is tiered to the FEISs 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. Methodologies used for analysis of individual resources that follow in this chapter can be found in their respective specialist reports in the Moskee Project Analysis File.

Past, Present, and Reasonably Foreseeable Activities Relevant to the Moskee Project

Various activities have already occurred, are occurring, or are expected to occur in the future within the project area. Past activities have contributed to the current condition of resources as described in this chapter. Ongoing and future activities may contribute to effects to 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 EA. Most have already been approved by other decisions or would require separate environmental analysis and public involvement. These activities are described below.

Past Activities

Coyote Timber Sale, cutting units completed 1999-2006:

- Commercial thinning to 80 square feet of basal area per acre: 46 acres
- Shelterwood seedcut: 436 acres
- Overstory removal: 103 acres
- Pine removal from hardwoods: 48 acres

Wish Timber Sale, cutting units completed 2001-2006:

- Overstory removal: 13 acres
- Hardwood restoration: 18 acres

- Shelterwood seedcut: 57 acres

Fires (see Map 2 in Appendix 1):

- Adams Prescribed Burns (2002-2005): 700 acres
- Baldman Prescribed Burns (2002-2005): 2,100 acres
- Cement Wildfire (July 2005): 61 acres
- Grand Wildfire (July 2002): 9 acres (T50N, R61W, section 20)
- Moskee Wildfire (1936): 7,174 acres
- Stanton Wildfire (July 2002): 22 acres (T49, R60W, section 28)
- Stanton Draw Wildfire (1963): 80 acres (T49N, R60W, section 36)
- Windmill Wildfire (August 1988): 8 acres (T49N, R61W, section 31)

Present Activities

Precommercial thinning to be completed in 2007: 312 acres

Coyote Timber Sale, cutting units to be completed by 2009:

- Commercial thinning to 80 square feet of basal area per acre: 288 acres
- Shelterwood seedcut: 692 acres
- Overstory removal: 138 acres
- Pine removal from hardwoods: 37 acres

Wish Timber Sale, cutting units to be completed by 2009:

- Overstory removal: 17 acres

Foreseeable Activities

Group selection is proposed on 857 acres under Alternative 3 and 1,758 acres under Alternative 4. This treatment would begin the process of creating uneven-age stand structure. A third of the acreage would be regenerated now in three- to five-acre patches. During the next harvest entry (15-20 years in the future), another third of the acreage would be treated with group selections. After the third entry, the stands would have developed uneven-age structure. These future entries would be subject to separate NEPA analysis.

Riflepit Timber Sale (to the east of the project area), cutting units to be completed by 2009:

- Hardwood restoration: 585 acres
- Commercial thinning: 574 acres
- Shelterwood preparation cut: 417 acres
- Shelterwood seedcut: 76 acres
- Overstory removal: 74 acres
- Meadow enhancement: 25 acres
- Pine encroachment: 62 acres

Moskee Land Exchange:

- This proposal to acquire privately held lands in exchange for NFS lands is in the development stages as of this writing. No decisions have been made. The National Forest System would acquire approximately 340 acres of private land within the

project area in exchange for approximately 336 NFS acres within project area (Map 3 in Appendix A). The proposed exchange includes additional acres outside the project area.

Coyote Post-sale Activities:

- Precommercial thinning: 116 acres
- Products other than logs (POL) thinning: 817 acres
- Noxious weed treatment

Wish Post-sale Activities:

- Precommercial thinning: 30 acres
- Aspen regeneration: 18 acres

Seventh-level watersheds that overlap the project area include 54,545 acres, 32,051 acres of which are NFS lands.

Physical Elements

Soils

The objective of soil resource management is to improve or maintain long-term soil productivity. Soil productivity is the inherent capacity of a soil to support the growth of specified plants, plant communities, or a sequence of plant communities. In order to improve or maintain long-term soil productivity, soil disturbance should be minimal and adequate measures taken to protect the surface soil, keep the soil in place, reduce compaction, and maintain nutrient and organic matter levels (USDA FS 1997).

Soils – Affected Environment

There are 14 soil map units within the Moskee project area (Table 6). Only five individual units comprise more than two percent of the project area. These five soil map units, which together comprise 91.5 percent of the project area, include 40, 41, 44, 91, and 201. Map units 98, 112, 134, and 155 each make up more than one percent of the project area but less than seven percent when combined. All other soil map units comprise less than one percent of the project area individually.

Table 6: Soils in Moskee Project Area

Soil Name	Description	Percent Slope	Acres in Moskee Project Area	Percent of Project Area
40	Citadel-McCaffery complex	3 - 10	3610.0	14.1
41	Citadel-McCaffery complex	10 - 30	9164.5	35.9
44	Cordeston loam	1 - 6	2157.0	8.5
45	Cordeston loam	6 - 10	19.4	0.1
46	Cordeston-Lakoa loams	2 - 6	90.4	0.4
76	Gullied land	---	79.8	0.3
91	Lail-Stovho loams	3 - 20	6600.9	25.9
97	Larkson-Lakoa loams	3 - 10	238.2	0.9
98	Larkson-Lakoa loams	10 - 60	258.9	1.0
112	McCaffery-Larkson complex	3 - 10	466.9	1.8
129	Onita loam	6 - 10	28.5	0.1
134	Peso-Paunsaugunt complex	6 - 10	497.0	1.9
155	Rock outcrop Vanocker complex	50 - 75	487.0	1.9
201	Vanocker-Citadel complex	20 - 60	1816.7	7.1

Soil Erosion: Natural Resource Conservation Service (NRCS) ratings of soil map units for soil erosion potential show that 91.0 percent of soil map units within the Moskee Project area have low to moderate erosion potential off of roads and trails even when 50 to 75 percent of the surface has been exposed. The exceptions are Vanocker soils in map units 155 and 201. On soil map units that occur on 71.8 percent of the project area, unsurfaced roads or trails have severe erosion hazard (NRCS 2006).

Soil Heating: NRCS ratings of soil map units for potential fire hazard damage show that four soil map units (40, 41, 112, and 201) have soil components with high potential fire

hazard damage rating for prescribed or wild fires of moderate intensity (116-520 BTUs/second/foot). These fires are hot enough to remove the duff layer and consume soil organic matter in the surface layer. For all of these soil map units, the soil component with the high fire hazard rating is McCaffery, which has this rating due to soil texture and the presence of rock fragments (NRCS 2006). This soil component accounts for 55 percent of map unit 112 and 15 percent of map units 201, 40, and 41 (NRCS 2006). Overall, the McCaffery soil component exists on about 9.6 percent of the project area.

Soil Compaction: Seven soil map units (40, 41, 46, 91, 97, 98, and 112) in the project area have components that may be prone to compaction. This applies to the Citadel component of soil map unit 40, slopes less than 15 percent on map units 41 and 98, the Larkson component of soil map unit 112, and all of the remaining soil map units specified.

Forest Plan monitoring of soil compaction within the Moskee project area was undertaken in a Baldman Timber Sale unit, located on Citadel loams, in 1998, 1999, and 2000 (USFS 2007a). Either timber harvest or post-sale activities occurred on this cutting unit during moisture level conditions when rutting (documented on the soil sampling data sheets) and soil bulk densities could be increased. Compaction monitoring in sloping areas of the unit showed a 23 percent increase in bulk density over the pre-harvest condition in 1999, followed by a drop to a six percent increase in bulk density over pre-harvest condition in 2000. In the upper flat portion of the unit (harvested in late 1999 or early 2000), a three percent increase in bulk density over the pre-harvest condition was measured in 2000.

Nutrient Removal: Three soil map units (40, 41, and 134) have major soil components that may have an effective rooting depth of less than 15 inches. In all three cases, the limitations occur in Paunsaugunt soils, which commonly have a restrictive layer at 10-20 inches in depth (NRCS 2006).

Additionally, seven soil map units (40, 41, 44, 45, 46, 129, and 134) have a major component that may have less than two percent organic matter in topsoil. Soil organic matter is about two percent in Paunsaugunt soils in map units 40, 41, and 134 (NRCS 2006). Paunsaugunt soils comprise 30 percent of map unit 134 and 15 percent of map units 40 and 41 (NRCS 2006). Therefore, the Paunsaugunt soil component exists on about 8.1 percent of the project area. In soil map units 44, 45, 46, and 129, the component with topsoil organic matter less than two percent formed under grass (Soils Notebook – Crook County Soil Survey). Standard 1102/Guideline (a) was developed to sustain productivity soils that formed under forested conditions. As this standard is targeted at timber production, it would not be considered applicable to soils that formed under grass.

Regeneration Hazard: Rated soils within the project area all have low to moderate potential for seedling mortality (NRCS 2006, 2007).

Soil Health: Soil Health Monitoring Assessments were conducted in 2006 in eight stands (011702-2, 011703-21, 011703-178, 011805-9, 011905-6, 011905-11, 011905-14, and 011905-15) within the project area. According to GIS analysis, surveyed units were located primarily on soil map units 41 and 91, with lesser areas of soil map units 44, 45, and 46. Sites surveyed were selected considering overlap with recently harvested timber sale units (Coyote and Wish timber sales) and fuels projects and/or possible disturbances

identified from recent digital orthophotos. Among sites in the project area, the surveyed sites were likely to be among those with the highest levels of soil disturbance. Soil Health Monitoring Assessments were based on observations made during walk-throughs of each site selected for surveying. Observations made during the assessments focused on soil characteristics relevant to Standard 1103/WCP Handbook Management Measure 13 (e.g., soil compaction, soil displacement, severely burned soil, and soil erosion) and their visual indicators. Overall observations were then used to rate the surveyed units as "Properly Functioning", "At Risk", or "Impaired." Upon completion of the surveys, all of the sites surveyed were rated as Properly Functioning. All eight locations/sites surveyed were also observed to have the minimum percent effective ground cover needed to keep erosion within tolerance limits based on the Soil Health Assessment Protocol (see USFS 2006d).

Outside the surveyed units, three areas are known where prescribed fire control lines created with bulldozers in mid-September 2005 had not been completely rehabilitated when surveyed in the summer of 2006. These areas are located off NFS roads 875.1C and 824.1C, and off non-system road U710143. The first two are in close proximity to a draw not shown on the National Forest streams layer. Vegetation cover along the dozer lines was estimated to be 10 to 85 percent for areas visible in late October 2006, although snow prevented a complete assessment of line condition (USFS 2006f).

Mass Movement: On-site slope-stability examinations were conducted in 2006 in nine stands (011801-30, 011801-70, 011801-91, 011805-40, 011902-56, 011902-57, 011905-6, 011905-15, and 012108-91) within the Moskee project area that, based on the preliminary proposed action, met the criteria specified in Standard 1108 of the Forest Plan. Surveyed areas were located on soil map units 40, 41, and 97.

Five of the surveyed units exhibited characteristics that may indicate that past soil movement has occurred, while four exhibited characteristics that may contribute to future mass movement (USFS 2004c). The characteristics most commonly seen were hummocky terrain and bent or leaning trees. Stand 011801-70 contained survey areas with slopes exceeding 60 percent. Stands 011902-57 and 011902-56 contained survey areas where vegetation cover was noted to be inadequate in some areas due to past burns, although soils were not considered to be hydrophobic (water-resistant). Stand 011805-40 contained a survey area situated above a spring and pond, although the surveyed slope did not appear wet (USFS 2006c).

Soils – Direct/Indirect Effects

The discussion of effects on soils addresses erosion, compaction, nutrients, heating, geologic hazards, and regeneration hazards. The Forest Plan provides direction relevant to the Moskee project for soil productivity (Standards 1101 and 1102), slope stability (Standard 1108), soil disturbance (Standards 1103, 1104, 1105, and 1106), reclamation and revegetation (Standards 1109, 1110, and 1111), and surface water runoff (1112, 1113, 1114, 1115, and 1116). Site-specific design criteria are discussed in the direct and indirect effects section below. Additional information and design criteria are provided in the Watershed Conservation Practices Handbook (Appendix 2).

Soil Erosion – Direct/Indirect Effects

Depending on site conditions and extent, varying percentages of erosion can result in a loss of the fertile soil surface layer, thereby contributing to reductions in organic matter and site productivity. This can reduce the ability of native vegetation to be established, and the growth of biomass (trees, forage) can be decreased.

The effect of mechanical forces (surface-disturbing activities) on soil movement are similar to, but may be greater than, natural soil erosion effects. Disturbances can be expected to contribute to the removal of soil surface cover (vegetation and litter) and various depths of upper surface layers of the soil (USFS 2005, page III-448).

Alternative 1 (No Action): Under Alternative 1, no new activities associated with this project would occur to alter existing soil conditions in the project area. Existing soil erosion concerns associated with use of roads would be expected to persist or could potentially increase over time if roads are not effectively closed or decommissioned. Hazard of high-intensity, stand-replacing fire events would generally be expected to increase over time. As has been observed after high-intensity Black Hills fires that have occurred since 2000, extensive areas of soil erosion can occur. This could occur in the Moskee project area in the event of a stand-replacing fire and site productivity would be expected to be altered in those areas where extensive erosion events would occur.

Alternatives 2, 3, and 4: All action alternatives propose commercial, non-commercial, and road-related activities that may result in varying amounts of erosion depending on site conditions and activity extent. Generally, the harvesting of timber itself is not a source of soil disturbance (Megahan 1976, in USFS 1996, page III-89). Soil health assessments conducted within the project area in 2006 classified soil erosion in the surveyed units in the zero to seven percent category for all units and photographs taken to supplement the information display that erosion conditions were likely at the lower end of that category range. None of the areas investigated were identified to have severe erosion conditions. Ground cover estimates were documented on soil health assessment and slope stability assessment forms. Most of the areas investigated had ground cover ranging from 65 to 95 percent. Some locations where prescribed fire had occurred in October or November 2005 were investigated in early to mid-June 2006. Photos of those sites document the retention of coarse woody debris (at least three inches in diameter), re-establishment of vegetation, and accumulation of needles on the ground from the ponderosa pine overstory retained on site. Dozer lines associated with the prescribed burn activity were investigated approximately one year following the burn activity. Although there was snow, portions of the lines were visible. Vegetation was becoming established and ranged from 10 to 80 percent cover.

In addition to information collected during the soil health assessments completed specifically for the Moskee project, vegetation ground cover information was collected during Forest-level soil bulk density sampling at a site that was also located in the Moskee project area (site located at T50N, R61W, section 21). Photos are available for this site, which was described to have 100 percent ground cover (USFS 2007b).

Logging systems and unit design may affect the degree and extent of ground cover alteration, which contributes to the level of soil erosion experienced in harvest units.

Erosion to the level that long term soil or site productivity may be impaired (described as detrimental erosion) is possible, but this condition was not observed during any of the surveys in the Moskee project area during on-site soil health assessments. Soil map units with soil components or site characteristics with the greatest likelihood of potential for erosion associated with activitiy disturbance to increase to the level that it may become detrimental include 155 (Rock outcrop-Vanocker complex) and 201 (Vanocker-Citadel complex). Together these soil map units comprise 9.0 percent of the project area. Under all action alternatives, commercial harvest and precommercial thinning are proposed on these soils (summarized in Table 7). The following design criteria, to be implemented under any of the action alternatives, would be expected to minimize effects associated with erosion on these soils: (1) Heavy equipment use on areas where Vanocker soils present a severe erosion hazard, such as immediately below rock outcrops in map unit 155 and on ridges and sideslopes in map unit 201, would be avoided consistent with WCPH Management Measure 9, Design Criteria (e); and (2) cable logging systems that lift one end of the log would be used on sustained slopes steeper than 40 percent and on moderately to severely burned slopes greater than 30 percent consistent with WCPH Management Measure 9, Design Criteria (g).

Road construction, reconstruction, pre-use maintenance, and decommissioning would occur under all action alternatives and would be expected to contribute to varying degrees to erosion of the road itself and erosion of soils located near the road. Erosion occurs on cut and fill slopes, the surface of the road, and the ditch paralleling the road. The amount of erosion is affected by road surfacing, cross-drainage off the road surface, and soil material of the road and cut and fill slopes (USFS 1996, page III-303).

It is estimated that one-third to one-half of road erosion occurs during the first year after construction, dropping quickly to near background levels within 2 to 3 years if continued use is not allowed (EPA 1976, in USFS 1996, page III-88). Roads continually used will continue to produce sediment, especially when use is allowed during wet weather (USFS 1996, p. III-88).

Under all action alternatives, road construction, reconstruction, pre-use maintenance, and decommissioning are shown by GIS analysis to cross soil map units that may present a potentially severe erosion hazard associated with on-road/on-trail activities. According to the Engineering Design Guidelines (Analysis File section D005), various measures can be used to protect highly erodible soils or road surface material, such as the placement of aggregate on the roadbed and using culverts; water diversion structures are generally considered for grades steeper than 10 percent, and cut/fill slopes are to be seeded as soon as possible following completion of the road template. These practices would generally be expected to keep erosion on new and reconstructed roads to a minimum in the Moskee project area. These measures, along with implementation of WCPH Management Measure 11, Design Criteria (d) (determining maximum cross-drain spacing) would be expected to further reduce concentration of surface runoff on highly erodible soils, thereby limiting erosion at those sites..

Yearlong closure of newly constructed roads following harvest activities is included in the design criteria to occur under all action alternatives. Reclamation and revegetation would occur in accordance with Forest Plan Standard 1109/WCPH Management Measure 12 and Forest Plan Standard 1110. Depending upon the closure and reclamation methods chosen, a short-term increase in erosion may occur immediately after road reclamation activities due to soil disturbance from recontouring, placement of water drainages, and/or

scarification of the road surface. Once drainages are in place and vegetation has become established on road surfaces, erosion from these roads would generally be expected to be eliminated or reduced to background levels.

Road decommissioning may also be expected to result in a short-term increase in erosion due to ground disturbance if practices such as ripping, placement of drainage structures, or recontouring are used. Once drainages are in place and vegetation becomes established at disturbed locations, erosion of road surfaces would be expected to be reduced or eliminated. This could result in a net reduction in erosion compared to the existing condition for some of the project area roads.

Types of effects would likely be the same under all action alternatives, but would be expected to vary by activity extent and location. Table 7 compares the amount of timber harvest and roadwork proposed under each alternative on soils rated as having severe or very severe erosion hazard.

Table 7. Timber Harvest and Roadwork on Soils Rated with Severe or Very Severe Erosion Hazard

Activity	Amount		
	Alternative 2 - Proposed Action	Alternative 3	Alternative 4
Harvesting (acres)			
Commercial	197	280	266
Non-commercial	34	63	59
Roadwork (miles)			
Construction	2.9	2.8	2.8
Reconstruction	47.7	53.9	53.9
Decommissioning	12.1	12.0	12.0

Table 7 displays timber management and road work activities proposed on soils with a high erosion hazard regardless of slope. Table 8 displays timber harvest on these soils by slope class.

Table 8. Timber Harvest on Soils Rated with Severe or Very Severe Erosion Hazard by Slope Class

Slope Class	Amount		
	Alternative 2 - Proposed Action	Alternative 3	Alternative 4
0-30%	115	172	163
30-40%	55	75	73
40-50%	22	28	26
Over 50%	5	5	4

Table 8 indicates that most timber harvest activities proposed on soil units with a high erosion hazard rating are located on slopes of 40 percent or less, which contributes to limiting the likelihood for detrimental erosion effects. Slopes of 40 percent or less are generally associated with lower water runoff velocities and increased ease of maintaining or reestablishing ground cover as compared to areas with slopes above 40 percent. None of the proposed road construction or decommissioning on these soil map units would take place on slopes over 30 percent. Approximately two-tenths of a mile of NFSR 893.1O would be

reconstructed on a slope of 30 to 40 percent. This road is currently not known to have any erosion issues. Application of design criteria described above would be expected to keep erosion within levels observed during surveys (the "seven percent or less" category on the soil health assessment form).

While hazard of stand-replacing fire would not generally be expected to increase under the action alternatives as under Alternative 1, fires may still occur along with associated soil erosion. The assumption is that fuel reduction treatments could reduce fire intensity and increase ease of suppression. It would generally be expected that following implementation of the action alternatives, the area would experience less extensive erosion and therefore fewer impacts to soil and site productivity as a result of wildfire events as compared to Alternative 1.

Soil Compaction – Direct/Indirect Effects

The compaction of soil can increase soil bulk density levels and can reduce large pore spaces within the soil profile, which can lead to impairment of water absorption and root growth at those specific locations. Fine-textured soils (loam soils or those with high levels of clay) can generally compact more than sandy soils. In addition, soils can typically compact more when soil moisture exceeds the plastic limit[5]. Detrimental compaction may occur with a few passes of harvest or activity equipment over moist soils, but may not occur or may take many passes of equipment over soils that are dry (USFS 2006b). To the degree that compaction contributes to vegetation growth reduction, increases in soil erosion and water runoff may occur to varying degrees.

Alternative 1 (No Action): Under Alternative 1, no new activities associated with this project would occur to alter existing conditions of soils within the project area. In the absence of further activities on compacted soil areas, existing levels of bulk density could be expected to decrease over time through various natural processes, such as root development, freeze/thaw cycles, or wildlife activity (e.g., gopher excavation).

Alternatives 2, 3, and 4: The Forest has conducted soil bulk density sampling periodically since 1998 (USFS 2007a). Various Black Hills soils, including some within the project area (see monitoring information for the Baldman cutting unit in USFS 2007a), can be compacted if heavy equipment use occurs when soils are wet or exceed the plastic limit. In order to prevent detrimental soil compaction and remain within Regional soil quality standards (USFS 1992), the following design criteria from the Region 2 Watershed Conservation Practices Handbook (USFS 2006) has been included in the action alternatives (see Chapter 2) 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).

All Moskee project action alternatives propose commercial and non-commercial activities that may result in varying amounts of soil compaction, depending on site conditions and activity extent, due to the weight of vehicles and equipment on the ground. The majority of these activities would take place on soils that were identified in the Soils Notebook/Crook County Soil Survey as having soil map unit components that may potentially be prone to compaction if activities occur during wet conditions. Soil Health Assessments (including those conducted on soil map units 41, 46, and 91) that included assessment of compaction and extent within the surveyed units indicated

[5] Soil moisture exceeds the plastic limit if the soil can be rolled into three-millimeter threads without breaking or crumbling (USFS 2006b).

compaction on from one to three percent of the unit area, primarily associated with old skid trails. In 1998 and 1999, pre-harvest and post-harvest soil bulk density samples were collected for monitoring identified at the National Forest level for soil compaction monitoring (comparing average pre-harvest bulk densities for activity units to post-harvest) in Baldman timber sale cutting unit #1 (T50N, R60W, section 31) (USFS 2007a). Documentation from this unit, which is within the Moskee project boundary, indicated an average increase in mean bulk density of 23 percent over the pre-harvest average bulk density conditions. Timber harvest or post-sale activities had occurred on this cutting unit during some level of soil moisture conditions where equipment was capable of causing ruts and soil bulk densities could be increased to an average of greater than 15 percent over pre-harvest conditions (both effects documented). Although it is unknown what characteristics or conditions contributed to a decrease in compaction levels, when the site was sampled again the following year the average bulk density of the site had returned to a level within Regional soil quality standards (no longer within what is defined as detrimental compaction).

Types of effects would be expected to be similar under all action alternatives but would be expected to vary by activity extent and location. Map 4 shows the location of the seven soil map units (40, 41, 46, 91, 97, 98, and 112) within the Moskee project area that are identified in the Soils Notebook/Crook County Soil Survey as having characteristics that indicate a greater likelihood of becoming compacted in excess of Regional soil quality standards if soil moisture conditions exceeded the plastic limit. All action alternatives propose activities on these soil map units. Alternative 2, which proposes the fewest acres of treatment overall, would be expected to have the smallest area with potential to experience detrimental compaction, followed by Alternatives 4 and 3. It is expected that activities proposed under these alternatives may result in varying levels of soil compaction, but increases in bulk densities would not be expected to exceed Regional soil quality standards. Specifically, this conclusion is based on the following assumptions:

1) That the WCPH design criteria specified above for the action alternatives would be applied or implemented as written for all proposed activities that occur on soil map units 40, 41, 46, 91, 97, 98 and 112.
2) That the results of soil health assessments (USDA Forest Service 2006c) generally identified compacted areas to be three percent or less at each of the sites visited in 2006 within the project area where mechanized activities had taken place within the last five years.
3) That soil bulk density sampling completed in June and July 2007 in areas with evidence of past timber harvest (stumps and/or decomposing slash) at two sample locations (one within the Moskee project area and another less than two miles from the project area with soil conditions similar to those of the project area) demonstrated similar soil bulk density levels to undisturbed condition bulk density levels obtained from the Natural Resources Conservation Service. The average soil bulk density for the site in the Moskee project area, located on soil map unit 97, was 1.24 gm/cc as compared to the representative value of 1.23 gm/cc acquired from the Natural Resources Conservation Service Web Soil Survey (NRCS 2007a). The average bulk density for the site sampled just outside

of the Moskee project area was 1.26 gm/cc as compared to the representative value of 1.23 gm/cc for the major soil map unit components listed for that area (Larkson-Lakoa loams).

4) That Forest-level soil bulk density monitoring (USFS 2007a) of pre-harvest and post-harvest conditions provides evidence to support statements made in the WCPH regarding soil compaction during dry conditions. Harvest activities that occurred during dry soil moisture conditions within the Black Hills caused no increase or limited increases in soil bulk densities, and average increases were within those specified in the Regional Soil Quality Standard Handbook (USFS 1992). Effects of proposed activities conducted in accordance with Forest Plan Standards and Guidelines and Watershed Conservation Practices are expected to be similar to effects of activities completed at locations sampled for Forest Plan monitoring, and average changes in soil bulk density would also be expected to be similar to changes documented at those locations.

Soil Nutrients – Direct/Indirect Effects

Alternative 1 (No Action): Under Alternative 1, nutrient levels may increase over time. Soil nutrients could be severely impacted in the event of a stand-replacing fire.
Alternatives 2, 3, and 4: Reduction in the level or availability to vegetation of soil nutrients may result from soil erosion, displacement, or compaction, or reduction of soil organic matter. All of these factors could be expected to contribute to lower site productivity by reducing nutrients available for plant growth (USFS 2005). Organic matter and nutrients may be lost when leaves, limbs, litter, and humus, are moved off-site.

Loss of organic matter and nutrients would generally be expected to occur where whole-tree yarding is used. Whole-tree yarding is estimated to remove 75-85 percent of the activity-generated slash from the stand and put it into mechanical harvester piles, leaving approximately 15-25 percent of the slash in the stand. This may be desirable in areas where reduction of fuel loading is necessary to target the reduction of high-intensity fires that may result in severe effects to the soil resource, but it may contradict Forest Plan Standard 1102/Guideline (a) in instances where specific treatments are located on soil map units 40, 41, and 134. In the case of the Moskee project, these treatments include shelterwood seedcut and group selection. In order to comply with Forest Plan Standard 1102 in locations where these soils exist and seedcut or group selection is proposed, the following design criteria would be implemented:

- 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 3 inches in diameter) would be returned to the site in quantities identified in Forest Plan Standard 1102/Guideline(a).

Table 9: Acres of Shelterwood Seedcut and Group Selection Proposed on Soil Map Units Meeting Guideline 1102a Criteria

	Alternative			
	1	2	3	4
Shelterwood seedcut (acres)	0	526	1,055	1,048
Group selection (acres)	0	0	433	775

Soil Heating – Direct/Indirect Effects

Alternative 1 (No Action): Under Alternative 1, limited soil heating effects caused by prescribed burning would not occur. Severe soil heating effects, such as complete consumption of ground cover vegetation, litter, and duff, development of water repellency, extensive soil erosion, decreased soil biological activity, and disturbance of the soil nitrogen pool, could occur more extensively in the event of a stand-replacing fire. These and other altered conditions of the soil may affect long-term productivity of sites (USFS 2005).

Alternatives 2, 3, and 4: To keep soil heating effects to a minimum, prescribed fires would be conducted to minimize the residence time on the soil while meeting burn objectives in accordance with WCPH Management Measure 13/Design Criteria (c).

Table 10: Comparison of Acres Proposed for Prescribed Burning on Soils Potentially Subject to Fire Damage

	Alternative			
	1	2	3	4
Acres of prescribed burns that would occur on soils having a high potential for damage from fires of moderate intensity (116-520 BTUs) (providing the necessary heat to remove the duff layer and consume organic matter in the soil surface) [1]	0	196	531	136

[1] Based on NRCS Soil Data Mart estimated percentages of the McCaffery component of soil map units

Under all action alternatives, prescribed burning is planned in stands that are shown by GIS analysis to contain soil map units 40, 41, and 201, which have components with high potential for impacts from fires of moderate intensity (116-520 BTUs/second/foot). Affected acres are shown by alternative in Table 10. Fires of this intensity provide the heat necessary to remove the duff layer and consume organic matter in the surface layer. A mosaic of burning conditions would be expected within the project area during a prescribed burn due to differences in factors such as vegetation type, wind speed, soil moisture, and relative humidity. The majority of areas receiving prescribed burns would not be expected to reach 115 BTUs/second/foot. An estimate from the Bald-Carnegie burn conducted in the Moskee project area in 2002-2005 showed burning occurred at the highest level of the prescription approximately 20 percent of the time. In areas where maintenance burning of earlier burns (such as Adams and Bald-Carnegie) is proposed, the time spent at a 115 BTU level would be expected to drop to five percent or less. Prescribed burning would therefore be expected to contribute to a reduction in the potential for high-intensity wildfires while causing only very limited hydrophobicity (water repellency) and soil erosion. Hydrophobic soil would be expected to break down enough to no longer affect hydrologic processes within five years (USFS 1996) and ground cover vegetation would be expected to recover within about three years, even in the case of a wildfire (Driscoll et al. 2004). Additionally, prescribed burns of low intensity would also be expected to consume some of the fuels, releasing some of the associated nutrients to the soil.

Slope stability examinations conducted in 2006 in stands 011902-56 and 011902-57 in the Moskee project area, where the Bald-Carnegie prescribed burn occurred in late September 2005 on soil map units 40 and 41, indicate that little vegetation cover was present in much of stand 011902-56 and at least a portion of stand 011902-57. Only one to two months of growing time, however, had elapsed between the burn and the exam. Soils in

these units were not noted as being hydrophobic, but some portions of stand 011902-57 had reduced infiltration. Photos of the surveyed units show trees to be scorched, although ground vegetation appears to be returning to varying degrees within the burned areas. Lack of complete revegetation may be due in part to the recent nature of the burns and to the effects of seven years of drought on soil moisture levels. Presence of rock fragments in McCaffery soils within these units may also lessen the ability of this soil component to retain moisture. In order to keep soil heating effects to a minimum, proposed prescribed burning would be conducted in accordance with WCPH Management Measure 13/Design Criteria (c) to minimize the residence time on the soil while meeting burn objectives.

Regeneration Hazard – Direct/Indirect Effects

Alternative 1 (No Action): Under Alternative 1, no new activities would occur that would be expected to affect regeneration on forested sites.

Alternatives 2, 3, and 4: Ponderosa pine regeneration may be impeded on marginal sites due to seedling mortality, plant competition, and other factors. Under all action alternatives, activities would take place on soil map units classified as having as having low to moderate potential for seedling mortality. Based on that classification and the Forest Vegetation section in this EA, which states that pine regeneration has occurred and is occurring in the project area, and that there is a need for thinning, seedling mortality is not expected to generally be of concern under any of the action alternatives.

Geologic Hazards – Direct/Indirect Effects

Soil mass movement (including soil creep, debris flows, slumps, and earthflows) can occur on unstable slopes if roads overload or undercut them, vegetation is removed from them, or runoff is directed onto them. The type of disturbance, scale of disturbance, soil type, soil water content, climatic conditions, and design criteria incorporated are factors in whether and to what extent soil mass movement may occur. Soil mass movement can also occur naturally.

Alternative 1 (No Action): Under Alternative 1, 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 high-intensity fire occurs and results in extensive tree mortality on these soils. Soil mass movement in the project area presently appears to be primarily in the form of soil creep.

Alternatives 2, 3, and 4: To keep the risk of future mass movement low within the Moskee project area, the following design criteria apply to proposed activities:

- Portions of stands 011902-56 and 011902-57 where past burns have left limited vegetation to protect slope stability would be avoided during timber harvest;
- No harvest would occur within 100 feet of the spring and pond in stand 011808-40; and
- On other areas to be harvested meeting the slope stability survey criteria, in contiguous areas or concentrations of areas exceeding one acre, at least 25 to 33 percent of the ponderosa pine canopy cover would be retained.

Under all action alternatives, shelterwood seed cuts and/or overstory removals, which would remove most or all of the timber canopy, are planned in areas where one or both of

the following conditions, identified in Forest Plan Standard 1108, occur:

- Soil map units with Citadel, Larkson, and Lakoa soil components exist on slopes over 30 percent, and/or
- Slopes exceed 55 percent.

Slope stability surveys conducted in 2006 in units meeting these conditions identified characteristics associated with past movement and/or increased potential for soil movement in some units, but did not locate active landslides. Where these conditions occur and most or all of the canopy is removed, the potential for soil movement would generally be expected to increase. A review of relevant literature (Sidle et al. 1985) and consultation with the Region 2 soil scientist indicates that retention of 25-33 percent crown cover could limit the likelihood for increased mass movement effects over what would generally be expected if no activities were to take place.

None of the action alternatives propose new roads crossing Lakoa, Larkson, or Citadel soils on slopes over 30 percent or on any slopes exceeding 55 percent.

Table 11: Shelterwood Seedcut and/or Overstory Removal on Soils Meeting the Criteria of Forest Plan Standard 1108

	Alternative			
	1	2	3	4
Shelterwood seed cut and/or overstory removal on soils with a major component (soil map units include 41, 40, and 97) with characteristics that may present an increased potential for mass movement (acres)	0	17	24	24

Soils – Cumulative Effects

The cumulative effects area for soils is the project area. This area was selected because direct and indirect effects on soils would be limited to this area. The time span for the cumulative effects analysis of soils is from 1997 to 2017 to allow for completion of all proposed activities.

Soil Productivity – Cumulative Effects

No long-term adverse effects on soil productivity are expected as a result of the full implementation of any of the action alternatives since they include implementation of Forest Plan Standards and WCPH design criteria. Elements of soil productivity are discussed below.

Soil Erosion: Proposed activities may result in additional limited, site-specific soil erosion and soil displacement. Soil would be moved during road construction under all action alternatives. Proposed road reconstruction and decommissioning have the potential to result in short-term increases in erosion, but design is targeted at reducing existing limited erosion in some locations by stabilizing currently disturbed areas and targeting the establishment of vegetation that would be expected to prevent or limit erosion in the long term. Soil health assessments were conducted within the Moskee project area in 2006 at locations that overlapped the Coyote and Wish timber sales and fuel reduction projects. Site information collected in 2006 on the soil health assessment forms for the area identified each of the sites to be in the “seven percent or less” category at each of the observed locations for soil erosion. Ongoing and future projects (such as the Coyote and Riflepit timber sales and post-sale activities) that could affect soil erosion levels in the project area are also expected to incorporate design criteria (Forest Plan Standards and WCPH direction) to prevent erosion from becoming detrimental. Through

application of site-specific design criteria intended to prevent or minimize soil erosion on soils that would be expected to be more susceptible to detrimental erosion (Chapter 2) WCPs, and other measures, it could be expected that any erosion that occurs would be minimal and within the limits of Forest Plan Standard 1103.

Soil Compaction: Soil health assessments conducted within the Moskee project area in 2006 at locations that overlapped the Coyote and Wish timber sales and fuels projects indicated a one- to three-percent extent of soil compaction at the observed locations; this compaction was located within past skid trails. Based on Forest-level monitoring (USDA Forest Service 2007a), full implementation of site-specific design criteria, including operation on dry or frozen ground (Chapter 2), WCPs, and other measures, total soil compaction would be expected to be below five percent in all activity areas, and andy increase in levels may be expected to decrease over time depending on various site and climatic conditions. Ongoing and future projects such as the Coyote and Riflepit timber sales, future uneven-age management entries, and post-sale activities that could compact soil in the project area would be expected to incorporate and implement similar WCPH design criteria to result in no to low levels of compaction that are within those specified in Regional soil quality standards and would not be considered to be detrimental compaction. Because these various project activities would take place over several decades, and Forest-level monitoring (USFS 2007a) has documented bulk densities to remain below or return to levels below those defined by Regional soil quality standards as detrimentally compacted, cumulative soil compaction would be expected to be minimal and within the acceptable limits set by Forest Plan Standard 1103.

Nutrient Removal: Timber harvest and/or fuel treatments are proposed to occur on soils with an effective rooting depth of less than 15 inches. These sites inherently have limited nutrient availability and water-holding capacity, which is generally visible in the growth of ponderosa pine at those locations and/or evident in site indices. Application of WCPH design criteria described above and in Chapter 2 would retain or return residual slash material in the stands with shallow soils (effective rooting depths of 15 inches or less), with the expectation that soil nutrient levels would generally be maintained or potentially improved. Ongoing and future projects such as the Coyote and Riflepit timber sales and post-sale activities that could affect soil nutrients in the project area would also be expected to incorporate and fully implement design criteria targeted at retaining on-site material with the expectation that soil nutrient levels would be retained.

Soil Heating: Prescribed burning is proposed to reduce fuels to contribute toward the goals of reducing extent of crown fire and increasing ease of suppression. Burns are expected to be conducted in accordance with WCPH Management Measure 13, Design Criteria (c) to limit the fire residence time at 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. Information collected during 2006 soil health assessments and slope stability surveys included information on prescribed burns completed in October/November 2005 in the project area (refer to Map 2 for the location of the Bald-Carnegie and Adams prescribed burns). The occurrence of hydrophobic (water-repellant) soils was investigated. None of the sites was found to have those conditions. Through review of photographs taken at the sites approximately nine months later (approximately one to two months into the new growing season and at the height of precipitation levels generally received in the Black Hills), no erosion was noted, coarse woody debris (at least three inches in diameter) was retained, and vegetation establishment was already occurring in early to mid-June 2006. Based on that information, there is little evidence to indicate any soil heating effects occurred in the project area in association with the fall 2005 prescribed burning. Additional prescribed burning in the area would generally be expected to have beneficial long-term effects by potentially limiting the extent or intensity of future crown fires that may occur

within the project area, thereby limiting soil heating that can be associated with high-intensity wildfires. No cumulative effects would be expected under any alternative.

In conclusion, based on the above information presented from project soil health assessments and Forest Plan monitoring, and the fact that similar activities would be implemented under any of the action alternatives for the Moskee project with design criteria to prevent or limit effects, the assumption is that effects would generally be similar to those that have been documented. Therefore, the sum of any land unit within the Moskee project area expected to be left in a severely burned, detrimentally compacted, eroded and displaced condition would be less than 15 percent for the action alternatives if standards and design criteria are applied or implemented as written.

Regeneration Hazards – Cumulative Effects

Soils within the project area are rated as having low to moderate potential for seedling mortality. Problems obtaining sufficient regeneration have not been encountered in the project area (refer to the Forest Vegetation – Regeneration section of this EA). Because this is generally an inherent characteristic of sites, the action alternatives would generally not be expected to influence soils characteristics to the point of altering regeneration of ponderosa pine, and cumulative effects would not be expected to occur.

Mass Movement – Cumulative Effects

As described in the Direct/Indirect Effects section above, design criteria is to be applied to certain treatments on soil map units with characteristics that may indicate potential for mass movement on slopes greater than 30 percent or any soil on slopes greater than 55 percent. With application of design criteria, potential for mass movement events would generally be expected to be limited to rates similar to those that are expected for the geology that exists within the area. Ongoing and future projects such as the Coyote and Riflepit timber sales and post-sale activities that could influence the likelihood of soil mass movement in the project area would also generally be expected to incorporate similar design criteria. Therefore, adverse cumulative effects are not expected.

Minerals

Minerals – Affected Environment

There are no active locatable or leasable mineral claims in the project area. The Forest Service has two gravel pits (Bald Mountain and Haines) for use on NFS roads. Neither pit is currently active. Both have been seeded and monitored for erosion control and noxious weeds. Other salable materials include building or landscape rocks. Permits are occasionally granted to members of the public for non-commercial collection of rocks along roadsides in the project area.

Minerals – Direct/Indirect Effects

Since there are no locatable or leasable mineral claims within the project area, none of these alternatives would be expected to impact any activities associated with potential mineral exploration. Proposed activities would not prevent mining claims from being located in the future.

Minerals – Cumulative Effects

Because the proposed action and alternatives would have no direct or indirect effects on the mineral resource, there would be no cumulative effects.

Water Resources

Water Resources – Affected Environment

The project area lies within portions of eight 7th level Hydrologic Unit Code (HUC) watersheds and two 6th HUC watersheds, listed in Table 12 and displayed in Map 1. The total watershed area is greater than the project area because portions of the watersheds are located outside of the project area boundaries.

Table 12. HUC 6 and 7 Watersheds in the Project Area

Forest Plan Watershed #	HU name - 6th level	HU code - 7th level	7th level acres	Percent of HUC7 in project area
8304	101202030202 (Grand Canyon)	10120203020201 10120203020202 10120203020203 10120203020204	6756.6 4732.3 7552.9 4630.4	48.4 100.0 24.1 85.2
8303	101202030201 (Cold Springs Creek)	10120203020103 10120203020104 10120203020105 10120203020106	6251.5 7949.3 9376.7 7296.8	5.9 69.2 21.6 52.8

Existing Stream Conditions

The project area has very little surface water. Large percentages of the major drainages, including 80 percent of mainstem Cold Springs Creek and 57 percent of Grand Canyon, are located on private property. Named tributaries of these streams are identified in Table 13.

Table 13: Streams in the Moskee Project Area as Determined Through GIS

Forest Plan Watershed #	7th level Watersheds	Named streams within the Moskee project area	Total stream miles in project area
8304	10120203020201	Grand Canyon	13.70
	10120203020202	Grand Canyon	15.96
	10120203020203	Riflepit Canyon	6.21
	10120203020204	Kirley Gulch, Riflepit Canyon, Wagon Canyon	10.25
8303	10120203020103	None	0.58
	10120203020104	Lost Canyon, Melquist Gulch, Stanton Draw	23.14
	10120203020105	Deer Creek	8.24
	10120203020106	Adams Gulch, Cold Springs Creek	12.03

Stream system dynamics can be divided into three areas: streamflow regime, water quality, and stream channel morphology.

Streamflow Regime: Peak flows in the Black Hills result from both rainfall and snowmelt. An examination of annual peak flows by the USGS indicates that rainfall-only peaks account for 90 percent of the peak flows in the Black Hills. Thus, the most significant flood events in the Black Hills are generally associated with high-intensity/high-moisture volume spring and summer thunderstorms. Approximately 50 percent of annual precipitation occurs in April, May, and June.

According to GIS analysis, there are 15.01 miles of perennial streams and 75.10 miles of intermittent streams in the project area. Based on field observations made in summer 2006, however, the classification of many streams in the GIS coverage as perennial or intermittent may not match the actual flow regime of these streams under current climatic conditions. Based on documentation from 41 potential stream crossing sites visited in 2006 and 17 Common Water Unit (CWU) sites visited during the Integrated Resource Inventory (IRI), the majority of mapped streams on National Forest System land in the project area appear to be primarily vegetated draws that likely flow only in response to runoff events. Springs exist throughout the project area and may contribute perennial flow to some channels, although the majority of springflow appears to be routed into stock ponds and tanks. Cold Springs Creek was the only mapped stream within the project area where flow that appeared to be perennial was observed during 2006 stream crossing surveys (USFS 2006d).

Water Quality: Water quality refers to the physical, chemical, and biological composition of a given streamflow and how these components affect beneficial uses. The existing water quality in project area drainages is a result of the natural characteristics of the watersheds along with the past and ongoing management activities on NFS and private lands. Changes in water quality parameters can adversely affect the support of beneficial uses if watershed conservation practices are not implemented.

No streams in the Moskee project area are known to have water quality impairments based on Wyoming's 2006 305(b) State Water Quality Assessment Report and 2006 303(d) List of Waters Requiring Total Maximum Daily Load (TMDLs) (WDEQ 2006).

Channel Morphology: Surveys conducted in 2006 indicated that portions of Cold Springs Creek, observed at two locations on NFS lands, were characterized by a small (bankfull width approximately two feet), well-vegetated, potentially perennial stream. The portion of the stream in the project area has an overall sinuosity of approximately 1.9, although Moskee (County) Road 141 and associated crossings have confined the stream in places and may have affected the natural meander pattern. Sinuosity is the degree to which the stream channel meanders back and forth and is determined by dividing channel length by valley length. In one location, the stream has cut a new channel in response to a culvert with a filled outlet and damaged inlet (USFS 2006d).

Observations of other streams on NFS lands in the project area indicate that the majority of other mapped channels are likely dry draws exhibiting little evidence of annual scour or deposition.

Floodplains: Floodplains are defined as "the flat area adjoining a river channel constructed by the river in its present climate and overflowed at times of high discharge" (Dunne and Leopold 1978, *in* USFS 1996). Periodic flooding in this area encourages the growth of riparian vegetation, which in turn slows erosion and traps sediment.

Floodplains in the project area are likely most affected by roads, which, when located near streams, may cause floodplain alteration and restriction. Moskee (County) Road 141 has likely affected floodplains along Cold Springs Creek.

Riparian Ecosystems: Riparian ecosystems in the project area are primarily associated with perennial drainages and spring systems. Some intermittent and ephemeral drainage bottoms may also contain plants associated with riparian areas, although likely to a lesser extent. Roads that restrict or alter floodplains commonly reduce or alter riparian vegetation. Cattle have also altered riparian systems dispersed throughout the project area via trampling and hoofshear in places such as Julis, Twin, Michelson, and Dugout Springs, and along drainage bottoms.

Wetlands: The National Wetlands Inventory (NWI) was used initially to delineate wetlands in the Moskee project area. Approximately 46 percent of NWI wetland acreage occurs on private land. Seven of the NWI wetland sites (see Table V, Hydrology Report, Moskee Project Analysis File, Section E004) are associated with named features (North Adams Reservoir and Kirley, Julis, O'Brien, Meadow, Michelson, and Scott Hardy Springs) on USGS topographic maps.

At least ten more named springs (West Ike, Miller, Silver, Gooseberry, Shorty, Dugout, Hain, North, Elk, and Bear) and additional unnamed (or locally named) springs are also present within the project area. Although these sites are not delineated in the NWI, some may have small wetland or riparian areas associated with them. Most springflow within the project area, however, is routed into stock tanks or ponds.

Constructed Watershed Features

Road Condition Inventory: A full inventory and report of the existing condition of roads within the project area can be found in the "Roads Analysis Process Report for the Moskee Project Area" (Analysis File, Section A001).

Connected Disturbed Areas (CDAs) are a measure of sediment sources and peak flow conditions (USFS 2006). CDAs may include bare soil patterns, compacted soils, roads, severely burned areas, or mine spoils. When a disturbed area flows into a water body without sufficient delay from vegetated filter strips or sediment detention structures, it is considered connected to the water body. CDAs contribute sediment to streams or wetlands, causing degradation of physical function and water quality and increased peak flows, which may alter physical channel processes. Most roads that cross streams will create a connected disturbed area. Road-stream crossings are identified in the Hydrology Report in the Moskee Project Analysis File. Forest Service Handbook 2509.25, Chapter 10 directs the Forest Service to "progress toward zero connected disturbed area as much as feasible" (USFS 2006).

Of the 41 potential stream crossing sites visited in 2006, at least 85 percent appeared to cross ephemeral portions of drainages. The majority of these crossings currently are likely to contribute little sediment to the drainage network due to road surface cover and drainage vegetation. One culvert on FSR 808.1 at Lost Canyon (in T49N R60W section 28, about 500 meters/0.3 mile upstream of the private property) was noted as contributing sediment to the stream due to a partially blocked culvert inlet. Two other culverts were noted as damaged or poorly aligned, but were not noticeably contributing sediment to the

stream channel. One of these culverts is located on Lost Canyon in T49N R60W section 28, approximately 1,700 meters (1.02 mile) upstream of the private property boundary. The other is located in T50N R61W section 17 on Moskee (County) Road 141, approximately 300 meters upstream of the National Forest boundary. Additionally, NFS road 870.2A runs along the bottom of an ephemeral portion of Adams Gulch (T50N, R61W, section 36; USFS 2006d).

Grazing Improvements: Numerous water developments exist throughout the project area. Most springs in the area have been developed for livestock watering. Fenced spring areas are generally protected from trampling and disturbance. Non-fenced springs or those with fences requiring repair remain vulnerable to overuse, particularly during dry years. Fences concentrate cattle into paths, and areas of bare, compacted earth may be found adjacent to fences, stock tanks, and ponds.

Water Resources – Direct/Indirect Effects

Streamflow Regime

Alternative 1 (No Action): Under the no action alternative, existing groundcover would not be disturbed by new activities, and small pockets of hydrophobic soils would not occur during prescribed fire. Streamflow would be expected to continue to depend on precipitation variability in the short term. Vegetation growth over time may slightly diminish water yield until a stand-replacing event (fire, etc.) occurs. In the event of a stand-replacing fire, runoff rates may increase due to vegetation loss and development of hydrophobic soils.

Alternatives 2, 3, and 4: Although any disturbance that reduces the density of live vegetation cover will increase runoff from forested watersheds, flow increases generally are not measurable until about 25 percent of the basal area of a forested watershed is cut. Cold Springs Creek is the only known, mapped perennial stream within the project area; the basal area in the 7th level HUC watershed (10120203020106) that it drains would be reduced by substantially less than 25 percent under any of the action alternatives. Reduction of evapotranspiration losses would be expected to occur within the first few years after harvest, but would likely decline over time with vegetation regrowth (USFS 1996) and would not be expected to produce measurable streamflow increases.

Table 14 displays the percent of each HUC 7 watershed proposed for commercial treatment by alternative.

Table 14. Percent of HUC 7 Watershed Acreage Proposed for Commercial Treatment

HUC 7 Watershed	Proposed Commercial Treatment – Percent of HUC 7 Watershed			
	No Action	Alternative 2	Alternative 3	Alternative 4
10120203020103	0	0.5	3.1	1.6
10120203020104	0	22.5	27.9	24.2
10120203020105	0	2.6	2.5	2.5
10120203020106	0	7.1	10.9	10.7
10120203020201	0	18.4	22.0	20.0
10120203020202	0	19.4	29.9	29.5
10120203020203	0	5.4	5.4	4.9
10120203020204	0	16.4	18.7	18.6

Percent basal area removed during each treatment type varies from about 25 to 40 percent for commercial thinning to 50 to 70 percent for shelterwood seedcut. Overstory removal cuts most of the remaining overstory trees, but the stand remains fully stocked with seedlings and saplings. Therefore, the actual reduction in basal area due to proposed treatments would be unlikely to exceed 15 percent in any watershed.

All action alternatives include prescribed fire. The burn mosaic created by prescribed fire may produce pockets of bare or hydrophobic soil. Based on the low percentage of soil map unit components with a high potential for fire damage existing in areas where prescribed burns are planned, and the minimal amount of time that prescribed burns would be expected to reach 115 BTUs/second/feet, these pockets would be expected to be very limited and would be unlikely to substantially affect streamflow.

All action alternatives include decommissioning of roads. Decommissioning conducted in accordance with Forest Plan Standards and Watershed Conservation Practices (WCP) Handbook Management Measures and Design Criteria would be expected to decrease the effects of road-related runoff transported to the drainage network. The degree to which these benefits are realized would depend upon the location and initial condition of the road and the specific measures that are implemented. Roads in or along drainage bottoms that may be disconnected from the drainage network through decommissioning are the same for all action alternatives. These include: U740119 (located in Stanton Draw), U710085 (part of which occurs along an unnamed tributary to Kirley Gulch), and U740076 (located in a wide drainage/meadow that may drain into Lost Canyon Creek). Additionally, reconstruction of NFS road 807.2C, which is located in an unnamed drainage, would occur under all action alternatives and could potentially decrease its impact on the drainage network.

Conversely, under all action alternatives, some of the new roads (N-4, N-5, and N-8) are shown by GIS analysis to have brief stretches (less than 0.1 miles total) that occur within 100 feet of unnamed tributaries to Cold Springs Creek, Grand Canyon, and Stanton Draw. Under all action alternatives, however, fewer roads would be constructed than would be decommissioned. Construction of these roads in accordance with WCPH Management Measures 9, 10, and 11, and associated design criteria, would be expected to minimize impacts of these roads on the affected drainages.

Water Quality

Alternative 1 (No Action): Under the no action alternative, no new activities would occur and no new sources of sediment would be created as part of this project. Existing roads would be expected to continue to contribute sediment to the drainage network at CDAs. New roads that may contribute sediment to the drainage network would not be built. Sediment delivery rates from roads in need of decommissioning or reconstruction may persist. Current conditions of dissolved oxygen, sediment, temperature, and water purity would generally be expected to persist, but could change in the event of a stand-replacing wildfire.

Alternatives 2, 3, and 4: Under all action alternatives, proposed activities would result in ground disturbance and increased use of existing roads, some of which cross streams or come close to channels. Connected disturbed areas, such as roads and other disturbed soils near streams, can deliver sediment to streams during runoff events.

Roads occurring in or along drainage bottoms that may be disconnected from the drainage network through decommissioning are the same for all action alternatives. These include U740119, U710085, and U740076. These roads are described further on page 50.

Road reconstruction also provides an opportunity to reduce sedimentation by improving water bars and other drainage structures and by relocating roads that are currently in or closely paralleling channels to side hills or ridges (USFS 1996). Reconstruction of NFS road 807.2C, which is located in an unnamed drainage, would occur under all action alternatives and could potentially decrease its impact on the drainage network. Additionally, two culverts that were identified during 2006 stream crossing surveys (see page 48) could potentially be corrected during road reconstruction that would occur under all action alternatives. Road 870.2A would also be reconstructed under all action alternatives.

Conversely, under all action alternatives, some of the new roads (N-4, N-5, and N-8) are shown by GIS analysis to have brief stretches (less than 0.1 miles total) that occur within 100 feet of unnamed tributaries to Cold Springs Creek, Grand Canyon, and Stanton Draw. Construction of these roads in accordance with WCPH management measures 9, 10, and 11, and associated design criteria, would be expected to minimize impacts of these roads on the affected drainages. Under all action alternatives, fewer roads would be constructed than would be decommissioned.

Excluding roads, harvesting systems and unit designs that cause the greatest amount of soil disturbance or compaction in or near stream channels would be expected to have the greatest potential for water quality degradation through sedimentation (USFS 1996). Harvesting within a streamside management zone or vegetation buffer strip could potentially lead to bank destabilization, reduction of large woody material necessary for channel stability, and increased stream temperature (USFS 1996).

Commercial treatments and precommercial thinning are not planned in the water influence zone located along Cold Springs Creek under any of the action alternatives. According to GIS analysis, all action alternatives would have commercial treatments and precommercial thinning that would occur to varying extents within 100 feet of other streams delineated in the forest stream coverage. Most of these streams appear to be primarily vegetated draws with low potential to transport sediment. With adherence to

WCPH Management Measure 3 Design Criteria (a, b, c, d, e, l, and m), proposed harvest treatments would be expected to have little affect on water quality within the Moskee project area under any of the action alternatives.

Effects of prescribed fire, proposed under all action alternatives, are discussed on page 50. Burning would be unlikely to substantially affect sediment transport under any of the action alternatives.

Best Management Practice Effectiveness: A Memorandum of Understanding between the Forest Service and the state of Wyoming approves the use of Regional Watershed Conservation Practices to meet the requirements of state Best Management Practices (USFS/WDEQ 2005). The Black Hills National Forest completed a BMP evaluation in 2003 (USFS 2003a). Chapter 4 of the evaluation cites two studies done on the Black Hills National Forest in 2001 by the Black Hills Forest Resource Association and the Wyoming Timber Industry Association. The study concludes, "These results highlight the consistent application and effectiveness of BMPs in the Black Hills and other National Forests." The evaluation goes on to review other studies or reports and comes to the conclusion that "These studies highlight the effectiveness of BMPs in forests throughout the United States." This evaluation demonstrates that BMPs are effective.

BMP field audits were conducted in 2004 and 2007 on the Wyoming portion of the Black Hills (including timber sales on state, private, and federal lands). The 2004 audit revealed that the BMP standards for application were met or exceeded on 97 percent of the total rated items (Wyoming Timber Industry Association et al. 2004). Ratings for BMP effectiveness confirmed adequate or improved protection of soil and water resources on 95 percent of the total rated items. This study showed an increase in effectiveness and application of BMPs over the 2001 study. Results from the 2007 evaluation are not yet available as of this writing.

Forest Plan management requirements and Regional WCPs would be implemented under all action alternatives. This would protect water quality, meeting the requirements of the Clean Water Act.

Channel Morphology

Alternative 1 (No Action): Under the no action alternative, no activities are planned that would affect stream morphology. Existing roads and road/stream crossings that affect channel morphology would continue to do so until some equilibrium between flow, sediment, channel, form, and disturbance is achieved. In the event of a stand-replacing wildfire, changes in sediment and runoff delivered to stream channels could lead to adjustments in stream morphology.

Alternatives 2, 3, and 4: Under all action alternatives, proposed activities would result in ground disturbance that may occur in close proximity to streams or draws as described in the section on water quality. This could result in increased sediment delivery to stream channels. Increased sediment in stream channels can alter channel width, depth, gradient, and the relative balance between pools and riffles, causing channel braiding and the accumulation of fines (USFS 1996). Implementation of watershed conservation practices previously described would be expected to minimize transport of sediment to Moskee project area drainages under all action alternatives.

Elevated peakflows increase stream energy, which may then be dissipated through bank cutting and bedload movement in areas that were previously stable. Effects of action alternative activities on streamflow within the Moskee project area are described in the section on water quantity. Implementation of watershed conservation practices previously described would be expected to minimize increased streamflow delivered to Moskee project area drainages under all action alternatives.

Riparian Areas, Water Influence Zones, and Wetlands

The discussion that follows centers on floodplains, riparian areas, and wetlands. The geomorphic floodplain and riparian ecosystem are both components of the water influence zone. The Forest Plan provides direction relevant to the Moskee project for riparian areas, water influence zones, and wetlands (Standards/Guidelines 1301, 1302, 1304, and 1306). Additional information and design criteria are provided in the Watershed Conservation Practices Handbook (FSH 2509.25).

Floodplains:

Alternative 1 (No Action): Under the no action alternative, no new impacts to floodplains would occur. Roads currently affecting floodplains would continue to do so.

Alternatives 2, 3, and 4: Commercial treatments, precommercial thinning, and prescribed burning are not proposed in the water influence zone existing along Cold Springs Creek under any of the action alternatives and are not known to be planned within any floodplain existing along the creek. County Road 141, which runs along Cold Springs Creek, is a county road and would be unchanged by this project. Function or values of known floodplains would therefore not be expected to change under any of the action alternatives.

Riparian Ecosystems and Wetlands:

Riparian ecosystems provide shade, bank stability, fish cover, woody debris, wildlife habitat, migration corridors, sediment storage and release, and surface-ground water interactions. Wetlands control runoff and water quality, recharge ground water, and provide special habitats.

Alternative 1 (No Action): Under the no action alternative, no new impacts to riparian ecosystems, water influence zones, or wetlands would occur due to proposed activities. Existing impacts from roads, grazing, and past harvest may persist.

Alternatives 2, 3, and 4: Direct impacts to riparian and wetland ecosystems would be most likely to occur under the action alternatives if these ecosystems are disturbed by timber harvest or road-related activities (such as stream crossings or placement of fill).

Riparian and wetland ecosystems within the project area are primarily associated with perennial drainages and spring systems. Most of these spring systems have been developed for livestock watering and many of these are fenced. Commercial treatments, precommercial thinning, and prescribed burning are not proposed in the water influence zone existing along Cold Springs Creek under any of the action alternatives. Activities in the water influence zone would be conducted in accordance with Forest Plan Standard 1301/WCP Handbook Management Measure 3 to ensure that riparian areas and wetlands are not adversely affected and that long-term stream health is maintained.

Adherence to appropriate Design Criteria associated with Forest Plan Standard 1301, WCP Handbook Management Measure 3, and other relevant direction would be expected to ensure that streams and riparian areas are not adversely affected and that long-term stream health is maintained.

Water Resources – Cumulative Effects

The cumulative effects area for water resources is the 7th-level watersheds that overlap the project area. The total area of these watersheds is 54,545 acres, including 32,051 acres of NFS lands (see Map 1 in Appendix 1). This area was selected because effects on water would not be expected to be discernable beyond the 7th-level watershed due to the distance from proposed activities and lack of surface water. The time span for the cumulative effects analysis for water resources is 1997 through 2047 to account for effects of recent, ongoing, and foreseeable projects, including future uneven-age management entries, and revegetation of areas that may be disturbed as a result of this and foreseeable projects.

Streamflow

Proposed activities could affect streamflow as described in the Direct/Indirect Effects section above. Flow increases are not usually measurable until about 25 percent of the basal area of a forested watershed is cut. Cumulatively, the ongoing (Coyote, Wish, and Riflepit timber sales), foreseeable (post-sale, future uneven-age management entries), and proposed activities would not be expected to decrease basal area by this amount in any 7th-level watershed. In addition, past, present, and foreseeable activities would take place over a period of up to 40 years; vegetation regrowth during this time would be expected to further decrease the potential for measurable increases in streamflow.

Water Quality

Perennial streams are limited in the Moskee project area and no streams in the project area are known to have water quality impairments based on Wyoming's 2006 305(b) State Water Quality Assessment Report and 303(d) List (see WDEQ 2006). With application of design criteria described earlier in this section, none of the alternatives would be expected to substantially change water quality conditions in the cumulative effects analysis area. Current projects and foreseeable activities that could affect water quality would also be expected to implement appropriate design criteria. Therefore, adverse cumulative effects are not expected.

Channel Morphology

With application of appropriate design criteria included in this EA, sediment and runoff would not be expected to enter stream channels in amounts likely to affect channel morphology. Current projects and foreseeable activities that could affect channel morphology would also be expected to implement appropriate design criteria. Therefore, adverse cumulative effects are not expected.

Floodplains

No direct/indirect effects on floodplains are expected to occur under any of the action alternatives. Therefore, no cumulative effects are anticipated.

Wetlands, Riparian Areas, and Water Influence Zones

Activities in the water influence zone would be conducted in accordance with Forest Plan Standard 1301 and WCP Handbook Management Measure 3. Current projects and foreseeable activities that could affect wetlands, riparian areas, and water influence zones would also be expected to implement appropriate design criteria. Therefore, adverse cumulative effects are not expected.

Biological Environment

Botany

The Moskee project area contains a variety of habitats. Most of the area, particularly the ridges and upper slopes, is dominated by ponderosa pine. Mixed conifer-deciduous communities are common in the project area as well. North-facing slopes are typically dominated by paper birch, quaking aspen, or a combination of the two species, often with a pine component. Meadow communities are relatively common in the wide valley bottoms.

Botanical resources in the Moskee project area were surveyed in 2004. Surveys related to other projects were conducted in the Moskee project area in 1995.

The Moskee project area contains habitat considered suitable to support several Region 2 sensitive plant species. Some is considered high-quality habitat for sensitive plant species and consists of stands of birch and birch/aspen as well as some riparian habitats. These sites often have a dense canopy cover and/or more moisture than average. They usually support a diversity of understory species, including mosses and lichens. Additionally, the project area contains open grassland habitats suitable for certain *Botrychium* species. These grassland areas could represent high-potential habitat for prairie moonwort (*Botrychium campestre*) and narrowleaf grapefern (*Botrychium lineare*).

Based on current information and professional judgment, species with habitat preferences differing from habitat types present in the Moskee project area are not analyzed in this document.

Plant Species of Local Concern (SOLC) – Affected Environment

No plant SOLC are known to occur in the Moskee project area. Habitat may be present in the project area for four plant SOLC: arrowleaf sweet coltsfoot (*Petasites sagittatus*), northern hollyfern (*Polystichum lonchitis*), pleated gentian (*Gentiana affinis*), and shining willow (*Salix lucida*), as shown in Table 15. A checklist of plant SOLC and rational for analysis or exclusion from analysis can be found in the Moskee Project Botany Specialist's Report in Section E001 of the Analysis File.

Table 15: Plant SOLC with Potential Habitat but No Known Occurrences in the Project Area

Species	Habitat Category
Shining willow *(Salix lucida)*	Riparian meadow
Arrowleaf sweet coltsfoot *(Petasites sagittatus)*	Riparian meadow
Northern hollyfern *(Polystichum lonchitis)*	Moist forest
Pleated gentian *(Gentiana affinis)*	Riparian meadow

Species listed in Table 15 are discussed below.

Shining Willow

Shining willow is considered globally secure (G5); it is currently not ranked/under review (SNR/SU) in Wyoming, but is ranked as critically imperiled (S1) in South Dakota (NatureServe 2007).

Species Distribution: Shining willow is widely distributed in the western and northern United States and Canada. Two subspecies may occur in the Black Hills. *Salix lucida* spp. *caudata*, commonly associated with streambanks, shores, wet meadows, and seeps, is at its easternmost limit in South Dakota. Two locations confirmed in 2006 are in the Bearlodge Mountains (Wyoming) at 4,800 feet elevation (one plant) and the northern Black Hills (South Dakota) at 5,000 feet (two plants). A third location (Bearlodge) documented by confirmed voucher has not yet been relocated. It is unknown whether a seed-producing population exists in the Black Hills. Two reported locations (central core Black Hills/South Dakota) were revisited in 2006, and *Salix* spp. found there were confirmed as other species.

Salix lucida spp. *lucida* is associated with streams and rivers in eastern North America. The taxon is at its westernmost limit in South Dakota. The single Black Hills occurrence, reported near Deadwood in 1913, has not been relocated.

Habitat: Within their range outside of the Black Hills, *Salix lucida* spp. *caudata* and *Salix lucida* spp. *lucida* are widespread and commonly associated with streambanks, shores, wet meadows, and seeps. Shining willow is considered a facultative wetland species in South Dakota and eastern Wyoming.

Arrowleaf Sweet Coltsfoot

Arrowleaf sweet coltsfoot is considered globally secure (G5). In Wyoming, the species is assigned a rank of imperiled (S2); in South Dakota it is considered critically imperiled (S1) (NatureServe 2007).

Species Distribution: Arrowleaf sweet coltsfoot occurs in Alaska, across Canada and the northern United States from Washington to Michigan and south to Colorado and Utah (USFS 2005).

Habitat: Habitat information for *Petasites sagittatus* is reported for 14 sites in the Black Hills National Forest in South Dakota (5,400 to 6,750 feet in elevation). The species is associated with cold, wet, marshy conditions and is a facultative wetland species. Black Hills reports are from South Dakota and display a variety of associated conditions: open to partial shade in dry to wet meadows along streams with saturated soils. White spruce, ponderosa pine, and aspen are documented at various sites and a variety of willow species at most sites (USFS 2005, 2007).

Northern Hollyfern

Northern hollyfern is currently assigned a global rank of secure (G5). In Wyoming it is assigned a rank of imperiled (S2) and in South Dakota critically imperiled (S1) (NatureServe 2007).

Species Distribution: Throughout its range, northern hollyfern is a circumboreal and subalpine forest fern occurring mostly in boreal and subalpine coniferous forests or alpine

regions. It is disjunct in the Black Hills, with the closest occurrences found in western Wyoming. Twenty sites have been reported in the northern Black Hills and Bear Lodge Mountains (USFS 2005, 2007).

Habitat: Northern hollyfern occurs in rock crevices and at the base of boulders, mostly in boreal and subalpine coniferous forests or alpine regions. It is commonly associated with white spruce, paper birch and beaked hazel on moist, shaded, north-facing slopes, in forested ravines and gulches on limestone substrates at elevations from 4,160 to 5,540 feet (USFS 2005, 2007).

Pleated Gentian

Pleated gentian is considered globally secure (G5) throughout its range. In Wyoming, it is assigned a conservation rank of apparently secure (S4); it is ranked imperiled (S2) in South Dakota (NatureServe 2007).

Species Distribution: In North America, pleated gentian occurs in states west of Wisconsin, Nebraska, Kansas, and Oklahoma and in Canadian provinces west of Ontario (USFS 2005). Occurrences are documented in the South Dakota part of the Black Hills National Forest (USFS 2005, 2007).

Habitat: In the Black Hills, pleated gentian occur primarily on limestone substrate in moist areas with open conditions, sometimes near wet meadows, fens, and stream margins (USFS 2005, 2007).

Species of Local Concern (SOLC) – Direct/Indirect and Cumulative Effects

The direct/indirect and cumulative effects area for plant SOLC is suitable plant habitat within the project area as described in the Field Reconnaissance and Survey Information section of Appendix 3, and includes moist forested and riparian meadow communities.

The cumulative effects analysis is bounded temporally by management activities of the last 10 years. A large wildfire in 1936 and past livestock management (last 100 years) are also considered to contribute to the existing condition in the project area. This provides the baseline on which this project is considered to add cumulatively to all other past, present, and reasonably foreseeable actions.

All Alternatives

In the Black Hills, the primary habitat for the four plant SOLC with possible habitat but no known occurrences in the project area (shining willow, arrowleaf sweet coltsfoot, northern hollyfern, and pleated gentian) is riparian vegetation communities and/or moist forested communities. Although the Moskee project area may contain suitable habitat conditions for these species, none were found within the project area during surveys. The focus of surveys conducted during the 2004 field season was on locating individual target plant species as well as identifying suitable habitat conditions. See Table 15 for the habitat category associated with each of these species. Refer to the Effects Analysis section of the Moskee Project Area Botany Biological Evaluation (Appendix 3) for a complete analysis by habitat type for these species. Implementation of activities in the Moskee project area would be expected to move conditions in the project area and the Forest toward achievement of applicable Forest Plan goals and objectives. As a result, plant SOLC habitat conditions are likely to persist within the project area.

Other Plant Species of Concern – Affected Environment

The single occurrence of Baker's mariposa lily (*Calochortus apiculatus*) known in the Black Hills and the states of Wyoming and South Dakota occurs in the Moskee project area. This occurrence was discovered in 2004 during survey work for the Moskee project.

Species Distribution: Baker's mariposa lily has a limited distribution that includes northwestern Montana, the upper panhandle of Idaho, far northeastern Washington, and small areas in southern British Columbia and Alberta. The Black Hills occurrence is apparently isolated more than 600 kilometers (370 miles) southeast of its known distribution range (Thomasson et al. 2006).

Habitat: In the Black Hills, Baker's mariposa lily occurs at the single known site on level to slightly inclined south- to west-facing slopes in a dry, open ponderosa pine forest in association with common juniper (*Juniperus communis*), creeping barberry (*Mahonia repens*), mountain ricegrass (*Piptatherum pungens*), lupine (*Lupinus argentea*), and kinnikinnick (*Arctostaphylos uva-ursi*) at an elevation of 6,118 feet (Thomasson 2006).

Other Plant Species of Concern – Direct/Indirect and Cumulative Effects

The direct/indirect and cumulative effects area for Baker's mariposa lily is the known site and surrounding habitat within the Moskee project area. The cumulative effects analysis is bounded temporally by management activities of the last 10 years. A large wildfire in 1936 and past livestock management (last 100 years) are also considered to contribute to the existing condition in the project area. This provides the baseline on which this project is considered to add cumulatively to all other past, present and reasonably foreseeable actions.

Alternative 1 (No Action)

Under Alternative 1, roads within the Baker's mariposa lily site would remain closed and in their current condition. No effects would be anticipated.

Alternatives 2, 3, and 4

The entire known occurrence of Baker's mariposa lily is outside treatments proposed under any alternative. Four existing native-surface NFS roads dissect the occurrence site. None of these roads would be used or maintained under any alternative (see design criteria on page 13). Currently the roads are vegetated and stable; erosion is not occurring and weeds are minimal. No direct, indirect, or cumulative effects on the occurrence would be anticipated.

Endangered, Threatened, or Sensitive Species

Federally Listed Plant Species:

A list of Federally endangered, threatened, proposed, and candidate species has been provided by Brian T. Kelly of the U.S. Fish and Wildlife Service (USFWS), Wyoming State Office, and last updated on August 8, 2007. No federally endangered, threatened, or proposed plant species occur on the Black Hills National Forest.

Region 2 Sensitive Plant Species

All Region 2 sensitive plant species and other target plant species occurring on the Black Hills National Forest were considered in this evaluation. Suitable habitat, defined as habitat that meets the requirements of a species, exists in the Moskee project area for several Region 2 sensitive plant species known to occur in the Black Hills. Different species may have different requirements and not all requirements are fully understood. Habitat may exhibit varying degrees of quality and can be suitable but unoccupied.

Based on current information and professional judgment, species with habitat preferences differing from habitat types present in the Moskee project area were not analyzed in this document. Table 16 summarizes Region 2 sensitive plant species known to occur in the project area, those having suitable habitat but no known occurrences in the project area, and those with habitat preferences differing from habitats present in the project area. The table also provides a rationale for the exclusion of species from effects analysis.

Table 16: Region 2 Sensitive Plant Species, Black Hills National Forest

Species	Black Hills Distribution and Habitat	Known To Occur in Project Area?	Suitable Habitat Present in Project Area?	Analyzed in This Document?
Prairie moonwort, aka Iowa moonwort *(Botrychium campestre)*	Prairie moonwort is extremely inconspicuous. Rangewide, it is considered a grassland species associated with sandy habitats in prairies, dunes, railroad sidings, and fields over limestone. In the Black Hills, there are currently 5 confirmed sites on NFS lands. Additional sites exist on private lands and at Wind Cave National Park. Black Hills sites are found on limestone in open grassland habitats usually with high forb diversity and often with a high percentage of bare and rocky soils. Little bluestem (*Schizachyrium scoparium*) and western snowberry (*Symphoricarpos occidentalis*) occur at the majority of sites.	No	Possibly: suitable habitat not fully understood	Yes
Narrowleaf grapefern, aka slender moonwort *(Botrychium lineare)*	Four occurrences are confirmed on BHNF lands and are located on the Bearlodge and the Hell Canyon Ranger Districts. All sites occur in open conditions on limestone substrate. Two sites are located on old (estimated 15-25 years) native-surface roadbeds. A third site is located adjacent to a gravel roadbed in open grassland. The fourth site, located on a large north-facing hillside, is not associated with any road development. Elsewhere in its range, this species has often been documented in areas of road disturbances and other human and natural disturbances.	No	Possibly; suitable habitat not fully understood	Yes
Leathery grapefern *(Botrychium multifidum)*	Currently, on the Black Hills, the majority of known occurrences are in mesic sites next to riparian areas dominated by spruce (*Picea glauca*) or mixed spruce-pine (*Pinus ponderosa*) along small, perennial streams in more or less open areas, and in or near old stream channels without permanent water but where occasional flooding events may cause scouring. Currently known populations are located a few meters from stream channels along Iron Creek, Nelson Creek, and Lost Cabin Creek, all in 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 with birch/hazelnut community on sandstone. Plants are found on moss-covered sandstone boulders and streambank berms near occasional pools of water. In general, plants in the Black Hills are associated with mossy mats, frequently with the moss *Climacium.* 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. Currently known to occur at elevations ranging from 4,620 to 6,400 feet.	No	Yes	Yes
Foxtail sedge *(Carex alopecoidea)*	In the Black Hills, foxtail sedge is currently known from two general areas: The Cement Ridge area along the South Dakota–Wyoming border, and in the Bear Lodge Mountains in Wyoming. Foxtail sedge has been found along open, perennial streams, often with old beaver dams or ponds. Documented occurrences are primarily in the transitional areas between saturated soils and the more mesic upland areas. Currently known elevation range is 3,840-5,900 feet.	No	Yes	Yes
Yellow lady's slipper *(Cypripedium parviflorum)*	Habitat in the Black Hills includes stream banks under both spruce and deciduous overstories, moist cliffs (usually north-facing), and moist areas/seeps under spruce or mixed conifer forest. Occasionally found higher on mesic forest slopes. Currently known to occur from 3,500 to 6,500 feet.	No	Yes	Yes

Species	Black Hills Distribution and Habitat	Known To Occur in Project Area?	Suitable Habitat Present in Project Area?	Analyzed in This Document?
Giant helleborine *(Epipactis gigantea)*	In the Black Hills this species is known only from Cascade Springs in Fall River County, South Dakota, at 3,400 feet elevation. It appears to depend on the constant moisture and warmth provided by the springs. No other warm springs are known on NFS land in the Black Hills.	No	No; no warm springs in project area	No
Trailing clubmoss *(Lycopodium complanatum)*	Known occurrences are located on shaded, north-facing slopes in white spruce/paper birch (*Betula papyrifera*) forest, in moist side drainages. Currently known elevation range is 5,000-5,820 feet.	No	No; spruce habitat is absent from the project area	No
Large round-leaf orchid *(Platanthera orbiculata)*	Found on shady, north-facing slopes in paper birch/hardwood stands, and occasionally in conifer forests on damp, rich humus soil. Currently known elevation range is 4,350-6,150 feet.	No	Yes	Yes
Sage willow *(Salix candida)*	One verified extant occurrence west of Deerfield (6,000 feet). Also a historical collection for the general area of "from Loring Siding to Minnekahta" (unknown land ownership). Habitat includes cold seep- or spring-fed saturated substrates produced by unusual hydrologic conditions where sedimentary layers of the Limestone Plateau intersect impermeable schist or shale of the crystalline Central Core. Community type associated with the occurrence is wet meadow fen.	No	No; these hydrologic conditions do not occur in the project area	No
Autumn willow *(Salix serissima)*	Fens and wet meadows. Known from McIntosh Fen (elevation 6,000 feet), Middle Fork of Boxelder Creek (5,800 feet), Nahant (5,620 feet) and Silver Creek (5,850 feet). Appears to occur in the same unique hydrologic conditions as *Salix candida.*	No	No; these hydrologic conditions do not occur in the project area	No
Bloodroot *(Sanguinaria canadensis)*	Bloodroot occupies floodplains, forested terraces, drainage bottoms, and north-facing footslopes in open, rich hardwood plant communities. The 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. Known elevation range is 3,940-5,000 feet.	No	No; project area out-side geo-graphic range	No
Highbush cranberry *(Viburnum opulus* var.	Occasional at mid-elevations in wet, shaded habitats along streams, springs and canyon bottoms. The large majority of documented occurrences are in drainage bottoms or lower parts of slopes with dry-mesic to moist soil conditions with partial shading. Known sites are primarily associated with paper birch /ironwood (*Ostrya virginiana*) and birch/hazelnut	No	Yes	Yes

Species	Black Hills Distribution and Habitat	Known To Occur in Project Area?	Suitable Habitat Present in Project Area?	Analyzed in This Document?
americanum)	(*Corylus cornuta*), with or without spruce or aspen (*Populus tremuloides*). A few sites are in pine/bur oak (*Quercus macrocarpa*). Paper birch is present at almost all known sites. Elevation range is 3,800-5,700 feet.			
Great-spurred violet *(Viola selkirkii)*	Known occurrences are restricted to high-elevation, cold and shaded to open microhabitats associated with vegetated granitic rock outcrops or white spruce forest with a highly variable understory. All known occurrences on NFS lands are located in the Black Elk Wilderness or the Norbeck Wildlife Preserve. Elevation range is 5,300-7,000 feet.	No	No; habitat conditions are not present in the project area	No

Species are grouped into appropriate habitat categories for analysis. Table 17 displays habitat category for each of the analyzed species.

Table 17: R2 Sensitive Plant Species with Suitable Habitat in the Project Area

Species	Habitat Category for Analysis
Prairie moonwort *(Botrychium campestre)*	*
Narrowleaf grapefern *(Botrychium lineare)*	*
Leathery grapefern *(Botrychium multifidum)*	Riparian meadow
Fox-tail sedge *(Carex alopecoidea)*	Riparian meadow
Yellow lady's slipper *(Cypripedium parviflorum)*	Moist forest/riparian meadow
Large round-leaved orchid *(Platanthera orbiculata)*	Moist forest
Highbush cranberry *(Viburnum opulus* var. *americanum)*	Moist forest/riparian meadow

*These species are analyzed separately.

The Moskee project area was surveyed primarily in 2004 for sensitive plant species, other target species, and high-probability plant habitat. Other surveys were conducted in the project area in1995. Information from all surveys conducted in the project area is used in this analysis.

No Region 2 sensitive plant species are known to occur in the Moskee project area. There is habitat, however, for several sensitive plant species.

Summary of Determination of Effects

Analysis determined that all alternatives analyzed in detail in this project may adversely impact individuals of sensitive plant species with suitable habitat in the Moskee project area, but are not likely to result in a loss of viability on the Planning Area nor cause a trend toward federal listing. Species to which this determination applies include prairie moonwort *(Botrychium campestre)*, narrowleaf grapefern *(Botrychium lineare)*, leathery grapefern *(Botrychium multifidum)*, fox-tail sedge *(Carex alopecoidea)*, yellow lady's slipper *(Cypripedium parviflorum)*, large round-leaved orchid *(Platanthera orbiculata)*, and highbush cranberry *(Viburnum opulus* var. *americanum)*. Detailed analysis in support of the determination is in Appendix 3.

Forest Vegetation

Introduction

Approximately 18,107 NFS acres in the project area are forested with ponderosa pine. Vegetative treatments over the last 15 to 20 years have resulted in four general stand structures of pine in the project area. Single-storied stands comprised of mature, dominant pine reflect the intermediate thinnings and preparation cuts of the last 15 to 20 years. Two-storied stands of mature forest overstory with abundant sapling/pole regeneration are the product of past shelterwood seedcut treatments. Regeneration in these stands often does not form a continuous second story but occurs in dense patches and stringers, creating an intra-stand mosaic of both single and two-storied conditions. A third general stand condition is one in which three distinct canopy layers can be found: seedlings/saplings, poles, and mature trees. These stands are very heterogeneous, with all the layers occurring together or singularly in patches or clumps. A fourth distinctive stand

condition is one dominated by stems 5 to 9 inches DBH. Small sawtimber[6] and/or large pine are sometimes present but usually only in minor, incidental amounts.

Development of a bur oak understory following pine regeneration cuts is not as common as elsewhere on the district, possibly due to the presence of abundant kinnikinnick. Where present, aspen and birch are usually represented in healthy, thrifty pole- and small sawtimber-size stems. Hardwood representation is usually confined to an understory sapling/pole component, except in draw bottoms and on moist north- and east-facing slopes. On these sites, hardwoods tend to occur as more pure, homogenous stands with only incidental pine, usually large remnant overstory trees. The Moskee Fire (Map 2 in Appendix 1) area best reflects this condition.

Pine Structural Diversity – Affected Environment

Existing habitat structural stage (SS) distribution for ponderosa pine on NFS lands in the project area is shown in Table 18. Structural stages are defined as follows.

SS 1: Grasses and forbs
SS 2: Seedlings and saplings
SS 3A: Young forest, trees less than 9 inches DBH, crown cover less than 40 percent
SS 3B: Young forest, trees less than 9 inches DBH, crown cover 40 to 70 percent
SS 3C: Young forest, trees less than 9 inches DBH, crown cover greater than 70 percent
SS 4A: Mature forest, trees at least 9 inches DBH, crown cover less than 40 percent
SS 4B: Mature forest, trees at least 9 inches DBH, crown cover 40 to 70 percent
SS 4C: Mature forest, trees at least 9 inches DBH, crown cover greater than 70 percent
SS 5: Late-succession forest

Table 18. Existing Ponderosa Pine Structural Stage Distribution in the Project Area

Structural Stage	Acres	Percent of NFS Pine Acres
1	293	1.6
2	146	0.8
3A	80	0.4
3B	197	1.1
3C	70	0.4
4A	7828	43.2
4B	6127	33.8
4C	2400	13.3
5	966	5.3

The project area is dominated by SS 4A, 4B, and 4C. While young pine is present in the understory in some stands, there are few stands composed primarily of these structural stages.

The mature structural stages that dominate the area provide opportunities for development of younger forest. Regenerating mature stands using the shelterwood method generally results in additional 4A immediately post-harvest but allows an understory to develop and provide stages 2 and 3 in the future. Commercial thinning also would reduce stocking and produce structure densities A and B.

[6] Generally, trees at least 9 inches DBH.

Age Class Distribution – Affected Environment

Stands on about 87 percent of pine acres are between 90 and 130 years old. This indicates that many of the stands were regenerated over a 50-year period from approximately 1875 to 1915, which corresponds to historical accounts of extensive logging activity. These stands currently make up the 4A, 4B, and 4C structural stage classes. There are few stands 60 to 70 years old, likely a result of the 1936 Moskee Fire. Within the past 20 years, an increase in the amount of regeneration harvesting has slightly increased the percentage of young pine stands.

Stocking Level – Affected Environment

Approximately 5,697 pine-forested acres have stocking levels outside desired Timber Management Zone levels using the methodology in Appendix H-3 of the Forest Plan. Of that total, 3,313 acres are stocked above desired levels (greater than 60 percent average maximum density, or AMD). Approximately 2,384 acres are below desired stocking levels (less than 20 percent AMD). Stands below desired stocking levels can generally either be left to grow and increase site occupancy or can be regenerated. Stands above desired stocking levels can be thinned.

Basal area is usually a good measure of stocking and site occupancy in most sawtimber and pole stands. About 6,616 acres (36 percent) of the pine acres have greater than 100 square feet of basal area per acre (an average of 22 feet between trees 14 inches DBH) and are at or approaching a silviculturally overstocked condition. Another 6,849 acres (38 percent) have BAs between 60 and 100 square feet per acre. This is usually considered fully stocked and equates, at least roughly, to an AMD of between 40 and 60 in sawtimber stands. Approximately 4,739 acres (26 percent) have stocking of less than 60 feet of BA, and are generally considered understocked using BA standards. Distribution of BAs is not even, with spikes at about 80, 110, and 160 square feet per acre.

Snags – Affected Environment

The Forest Plan sets an objective (211) to provide an average of three hard snags per acre in each Management Area, well-dispersed across the National Forest. These snags should be greater than nine inches DBH and at least 25 feet tall. One-quarter of the total should be greater than 14 inches DBH. This objective applies to the Forest-wide scale. Due to recent large fires and bark beetle outbreaks, the National Forest is currently exceeding the Forest-wide snag density objective (USFS 2006a).

There are no Forest Plan objectives that define desired snag densities within a project area. Standard 2301, however, states that if snag densities within a project area are below the Forest-wide objective, then all snags must be retained unless they are a safety hazard. If the project area meets the Forest-wide objective, then only snags greater than 20 inches DBH must be retained. Standard 2305 requires that all soft snags be retained unless they are a safety hazard.

Timber stand data collected in 2002 includes estimates of snag density. Current average snag densities in the conifer-forested portion of the Moskee area are approximately six hard snags at least 10 inches DBH and 25 feet tall per acre, of which at least approximately two hard snags are at least 14 inches DBH. Snag densities in the project area therefore meet the criteria of Forest Plan Objective 211. Snags are well distributed

across the project area.

Regeneration – Affected Environment

As noted above, pine regeneration has occurred and is occurring in the project area where the crown canopy has been opened and where competition from grasses, forbs, and brush (often bur oak) is relatively low. Approximately 1,683 acres of pine regeneration in need of precommercial thinning have been identified. Another 35 acres have been tentatively identified for POL thinning. There is a high degree of correlation between the presence of kinnikinnick and the success of pine regeneration. Prolific pine regeneration is nearly always associated with a surface cover of kinnikinnick. This condition is typical throughout the Bearlodge Ranger District.

Insects and Disease – Affected Environment

Mountain pine beetle activity in the project area is at endemic levels, though increased infestation has been noted in the southeast part of the project area bordering sites of substantial infestation in South Dakota.

Stand parameters of density (basal area), structure, and average stand DBH were used to assess the risk of mountain pine beetle outbreaks. The analysis uses the risk classes developed in Research Note RM-385 (1980) by Edminster et al. These stand elements are then combined to arrive at a risk rating for each stand. Existing pine acres by risk class (Low, Moderate, High) are shown in Table 19.

Table 19: Mountain Pine Beetle Infestation Risk in the Project Area

Risk Class	Acres
High	8,951
Moderate	8,637
Low	519
Total pine acres	**18,107**

Currently, the combined acreage at moderate or high risk is 17,588, or 97 percent of the pine cover type total.

Analysis of mountain pine beetle risk does not reflect short-term climatic trends, specific weather events, or the effect of other insects/disease agents that could increase the risk in individual stands. For example, storm damage in the form of windthrow or crown breakage in the midst of an extended dry period could increase the incidence of the *Ips* engraver beetle, which could weaken trees already under moisture stress and increase susceptibility to mountain pine beetle attack. The resulting incidence and severity of mountain pine beetle in this scenario may not be solely a product of the stand parameters discussed above. Environmental factors such as these make absolute “bug-proofing” of stands nearly impossible.

Other insects and diseases are having minimal impact on the area. No factors are foreseen at this time that would increase this impact in the next five to 10 years.

Pine Structural Diversity – Direct/Indirect Effects

Resulting structural diversity of pine in the project area is shown in Table 20. All action alternatives would increase the percent of SS 2 and 4A pine stands while decreasing 4B and 4C.

Table 20: Pine Structural Diversity in the Project Area by Alternative

Structural Stage	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Acres	%	Acres	%	Acres	%	Acres	%
1	293	1.6	293	1.6	579	3.2	879	4.9
2	146	0.8	525	2.9	669	3.7	548	3.0
3A	80	0.4	918	5.1	1368	7.6	1066	5.9
3B	197	1.1	228	1.3	286	1.6	232	1.3
3C	70	0.4	70	0.4	62	0.3	62	0.3
4A	7828	43.2	11177	61.7	11090	61.2	10992	60.7
4B	6127	33.8	3084	17.0	2460	13.6	2701	14.9
4C	2400	13.3	846	4.7	627	3.5	661	3.6
5	966	5.3	966	5.3	966	5.3	966	5.3

SS classification based on basal area (BA) may under-report the actual acreage in SS 2 and 3. The analysis assumed that shelterwood seedcuts and shelterwood seedcut/overstory removal treatments would result in SS 4A. In both treatments, inclusions and patches of SS 2 or 3 may result but are overridden by the BA in SS 4 structural stages. Areas of SS 2 or 3 would be estimated to comprise from five to 15 percent of the stands treated with these prescriptions.

Age Class Distribution – Direct/Indirect Effects

Under Alternative 1, age class distribution and disparity would not be expected to change in the next five to 10 years in the absence of disturbance events such as beetle infestation or wildfire. Beyond 10 years, effects would be likely to include an increase in mortality due to competition among trees and an increase in merchantable defect due to disease. In addition, sustainability of the timber resource over the next several decades may be compromised since few stands are currently young and available to grow into the next generation of mature forest.

Age class distribution would become more balanced under Alternative 2 through overstory removal cuts (approximately 1,157 acres), which would move stands into younger age classes. In addition, shelterwood seedcuts on approximately 958 acres would be expected to result in establishment of regeneration under the reserve trees, providing future young stands. Currently, young stands are noticeably few across the landscape, so an increase in acreage would be beneficial.

Alternative 3 would have similar effects through overstory removal cuts on approximately 1,747 acres and shelterwood seedcuts on approximately 1,695 acres. In addition, group selection cuts (286 acres of “groups”) would be expected to result in future young forest.

Alternative 4 would conduct overstory removal on 1,156 acres and shelterwood seedcut on 1,695 acres. Effects on age class distribution would be similar to those of Alternatives 2 and 3. Group selection cuts would take place in more stands (586 acres of "groups"), resulting in additional young stands in the future.

Stocking Level – Direct/Indirect Effects

The effects of Alternative 1 would be an increase in standing timber volume as the size of the existing trees increases with growth, a reduction of diameter growth due to age and overstocking (trees would continue to grow, but at a slower rate due to competition), an increasing risk of mountain pine beetle infestation, and an increased risk of stand-replacing wildfire. Acres of pine type that are above Management Zone levels would experience reduced growth due to overcrowding and competition for nutrients, water, and light.

Under Alternative 2, ponderosa pine stocking levels would decrease where thinning and prescribed burning occur, but stands would remain fully stocked. Decreased stocking levels would be expected to increase diameter growth of individual trees, increase plant species composition in the understory, reduce the risk to stands from insects and disease, and improve the general vigor of the stands treated. The use of commercial treatments in this alternative would provide the opportunity in stands of merchantable trees to reduce stocking levels and move the area toward desired Forest Plan stocking levels. Basal area per acre would decrease in treated stands. Following treatment, approximately 14,800 acres would be within the Timber Management Zone for ponderosa pine (20 to 40 percent of AMD) as compared to the current 12,410 acres.

Effects would be similar under Alternative 3, with 14,400 acres in the Timber Management Zone following treatment.

Under Alternative 4, stocking levels would be slightly higher than under Alternative 3, based on total acres treated. The major difference between these alternatives is the substitution of understory mulching treatment in Alternative 4 for commercial treatments in Alternative 3.

The effect on the timber resource would be an increase in the quality of the timber through the removal of damaged, diseased, and poorly formed trees, and an increase in individual tree growth by releasing the remaining trees from competition for light, water, and nutrients. Trees would be expected to develop larger diameters due to a reduction of competition, which concentrates the stand growth in fewer stems.

Snags – Direct/Indirect Effects

Snag harvest is not proposed under any alternative. Alternative 1 would not affect existing snags. Individual tree mortality would be likely to continue in dense stands at rates higher than under the action alternatives. Snag density would be likely to be highest under this alternative. Cutting of snags for fuelwood would continue to be prohibited under all alternatives, though illegal cutting is likely to occur adjacent to roads.

Under Alternatives 2, 3, and 4, design criteria specify that all existing snags would be left standing except those cut for safety reasons; thus all alternatives would meet Forest Plan Standards 2301 and 2305. Prescribed burning would be expected to create more snags

than are lost, but most of these snags would probably be in small size classes. These alternatives would decrease road density, which may reduce the likelihood of illegal cutting of snags for fuelwood. There is currently a good distribution of snags within the project area, contributing toward Objective 211. As demonstrated by structural stage distribution, mature trees that could become snags in the future dominate the project area (see page 68).

Proposed silvicultural treatments in the project area are specifically designed to increase tree vigor, increase tree resistance to mountain pine beetles, and decrease susceptibility to crown fire. These conditions would be expected to decrease tree mortality rates from what might naturally occur. It is therefore reasonable to assume that snag recruitment in the project area could be reduced by all action alternatives. Because Alternative 2 proposes treatment on the fewest acres, snag recruitment would be expected to be the highest of any action alternative. Alternatives 3 and 4 would have the greatest potential for lower snag recruitment due to an increase in area harvested. Potential for lower snag recruitment would be somewhat mitigated by prescribed fire proposed under the action alternatives (the most under Alternative 3 and least under Alternative 4), because it is likely that some mortality would occur as a result of prescribed fire. Most of the mortality would, however, be expected to occur within a few years of burning, and fire may therefore have little mitigating effect on long-term recruitment.

Regeneration – Direct/Indirect Effects

Alternative 1 would not affect pine regeneration potential or success. Shelterwood seedcuts, group selections, and other low-density cuts proposed under Alternatives 2, 3, and 4 would be expected to result in prolific natural regeneration of pine and other native tree species. Prescribed burning would be expected to adversely affect existing pine regeneration in burned areas, but this is considered acceptable where the stand of management interest is the mature overstory, and the burning reduces competition from this advanced regeneration. Burning would have a beneficial effect on seedling establishment for natural regeneration by exposing some areas of mineral soil. Stimulation of oak sprouting may also result from treatments, which may not be desirable in timber management areas. Spring burning may help reduce the vigor of oak sprouts. Past prescribed burning in the area has resulted in lower initial stocking levels, but has not prevented successful regeneration within 5 to 10 years. Alternative 3 proposes the most prescribed burning, followed by Alternatives 2 and 4.

Insects and Disease – Direct/Indirect Effects

Table 21 compares current mountain pine beetle risk for ponderosa pine stands to the estimated risk after implementation of each alternative.

Table 21: Mountain Pine Beetle Infestation Risk by Alternative

Risk Class	Acres			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
High	8,951	3,860	3,464	3,739
Moderate	8,637	12,393	12,267	12,461
Low	519	1,854	2,367	1,907

Currently almost half of the project area pine stands are at high risk of infestation and most of the rest are at moderate risk. Under Alternative 1, overstocked stands of pine would continue to be at high risk of loss by mountain pine beetle. This risk would be likely to increase over time due to increasing stocking levels.

The action alternatives would reduce acres at high risk and increase acres at low and moderate risk. Alternative 3 would reduce high-risk acres the most (by 61 percent), and increase low-risk acres the most. Alternative 2 would decrease high-risk acres by 57 percent and Alternative 4 by 58 percent.

Slash resulting from proposed activities, if not treated properly, could facilitate tree mortality due to *Ips* beetle infestation. Past practices of lopping, scattering, and burning of slash piles within a year of treatment have reduced *Ips* infestation to less than a few trees per acre. Proposed post-sale treatments for fire risk reduction would also reduce the probability of insect infestations. Scattering slash facilitates the rapid drying of fuels, which reduces conditions favorable for *Ips* buildup.

Cumulative Effects

The cumulative effects boundary for age class distribution, stocking level, snags, and regeneration is the project area boundary, where the direct and indirect effects of the project would occur. The cumulative effects boundary for insect and disease risk is the 7th-level hydrologic unit code watersheds that overlap the project area (54,545 acres, Map 1). This boundary was selected because mountain pine beetle infestation levels in the project area could be affected by levels in adjacent forested areas, and vice versa. The time span for the cumulative effects analysis of vegetation management is from 1990 to 2047 to account for past activities that are still affecting forest resources, completion of all activities included in the Moskee project proposals, and future uneven-age management entries.

Pine Structural Diversity – Cumulative Effects

The cumulative effects boundary for structural stage is the boundary of the relevant management area across the National Forest. This boundary is prescribed by Forest Plan Objectives 4.1-203 and 5.1-204. The time span for the cumulative effects analysis of structural stage is from 2006, when Forest-wide structural stage data were updated and frozen, to 2017, when activities associated directly with the Moskee project are expected to end.

The Phase 2 Amendment includes objectives for distribution of pine stand structure and tree size. These objectives are applied on a management area basis. The objectives are identical for MAs 4.1 and 5.1:

Objectives 4.1-203 and 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.

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

**10% of the structural stage 4 ponderosa pine acreage in the management area will have an average tree size of "very large". Seek*

opportunities to increase understory shrubs in open-canopy structural stages.
***Active management is allowed, and may be necessary, to provide desired late-successional characteristics.*

As defined in forest vegetation databases, stands of "very large" trees have an average tree diameter at breast height (DBH) of at least 9 inches and, of the trees over 9 inches DBH, the average DBH is at least 16 inches.

To demonstrate how the Moskee project contributes to Objective 4.1-206, Table 22 displays existing structural stage distribution in MA 4.1 across the Forest and how the Moskee alternatives would affect this distribution.

Table 22. Ponderosa Pine Structural Stage Distribution in MA 4.1 (Forest-wide)

Structural Stage	Objec-tive (%)	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
		Acres	%	Acres	%	Acres	%	Acres	%
1	5%	2,114	6%	2,114	6%	2,114	6%	2,114	6%
2	5%	581	2%	778	2%	778	2%	778	2%
3A	10%	1,724	5%	1,786	5%	1,829	5%	1,829	5%
3B	15%	1,020	3%	1,020	3%	1,020	3%	1,020	3%
3C	5%	532	1%	532	1%	532	1%	532	1%
4A	25%	11,497	32%	12,109	34%	12,242	34%	12,208	34%
4B	25%	10,727	30%	10,333	29%	10,313	29%	10,313	29%
4C	5%	6,597	18%	6,104	17%	5,948	17%	5,982	17%
5	5%	1,010	3%	1,010	3%	1,010	3%	1,010	3%

The table above shows that the Moskee proposed action and alternatives would generally have little effect on distribution of pine structural stages in MA 4.1 across the Forest. All alternatives would contribute toward meeting the objective by increasing stages 2 and 3A and decreasing stages 4B and 4C. All alternatives would, however, increase stage 4A, which is already well above the objective. This change is a result of actions proposed to decrease fire hazard and mountain pine beetle infestation risk. Projected effects of the ongoing Coyote and Wish sales are included in the above table. Future uneven-age management entries (at approximately 15-20 and 30-40 years) would reduce the amount of 4A and further increase stages 2 and 3.

Table 23 displays Forest-wide acres and percentages of very large trees in structural stage 4 in MA 4.1, and how these figures would change as a result of the Moskee project. MA 4.1 is currently above the objective for acres of stands dominated by very large trees. All action alternatives would further increase the percentage as a result of thinning from below to reduce fire hazard and beetle infestation risk. Shelterwood seedcut would also contribute toward this increase as the larger trees are retained to provide a seed source.

Table 23. "Very Large" Tree Distribution in MA 4.1 (Forest-wide)

Object-tive	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
% of SS4	Acres	% of SS4	Acres	% of SS4	Acres	% of SS4	Acres	% of SS4
10%	5,754	19%	6,037	21%	6,309	22%	6,451	23%

To demonstrate how the Moskee project contributes to Objective 5.1-204, Table 24 displays existing structural stage distribution in MA 5.1 across the Forest and how the Moskee alternatives would affect this distribution.

Table 24. Ponderosa Pine Structural Stage Distribution in MA 5.1 (Forest-wide)

Structural Stage	Objec-tive (%)	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
		Acres	%	Acres	%	Acres	%	Acres	%
1	5%	61,938	13%	61,938	13%	61,938	13%	61,938	13%
2	5%	10,324	2%	10,507	2%	10,650	2%	10,530	2%
3A	10%	18,833	4%	19,610	4%	20,017	4%	19,715	4%
3B	15%	27,966	6%	27,996	6%	28,055	6%	28,000	6%
3C	5%	12,934	3%	12,934	3%	12,927	3%	12,927	3%
4A	25%	172,401	36%	175,138	37%	175,201	37%	175,440	37%
4B	25%	126,491	27%	123,811	26%	123,206	26%	123,447	26%
4C	5%	44,535	9%	43,492	9%	43,425	9%	43,425	9%
5	5%	628	<1%	628	<1%	628	<1%	628	<1%

The table above shows that the Moskee proposed action and alternatives would have little effect on distribution of pine structural stages in MA 5.1 across the Forest. All alternatives would contribute toward meeting the objective by increasing stages 2, 3A, and 3B and decreasing stages 4B and 4C. All alternatives would, however, increase stage 4A, which is already well above the objective. This change is a result of actions proposed to decrease fire hazard and mountain pine beetle infestation risk. Stage 3C is currently below the objective, and Alternatives 3 and 4 would decrease it further (by seven acres or .05%) due to thinning of a fire-prone stand. Projected effects of the ongoing Coyote and Wish sales are included in the above table.

Although not shown in Table 24, Alternative 3 would create 286 acres of SS 1 and Alternative 4 would create 586 acres of SS 1 as a result of the “group” openings in the group selection treatments. Though this structural stage has a five- to ten-year benefit as wildlife foraging areas, its longer-term importance is in its contribution to future structural stage 2 and 3 acreage. Future uneven-age management entries (at approximately 15-20 and 30-40 years) would reduce the amount of 4A and further increase stages 2 and 3.

Table 25 displays Forest-wide acres and percentages of very large trees in structural stage 4 in MA 5.1, and how these figures would change as a result of the Moskee project. MA 5.1 is currently slightly above the objective for acres of stands dominated by very large trees. All action alternatives would further increase the percentage as a result of thinning from below to reduce fire hazard and beetle infestation risk. Shelterwood seedcut would also contribute toward this increase as the larger trees are retained to provide a seed source. Understory mulching proposed in Alternative 4 would contribute to the largest increase among the alternatives.

Table 25. "Very Large" Tree Distribution in MA 5.1 (Forest-wide)

Object-tive	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
% of SS4	Acres	% of SS4	Acres	% of SS4	Acres	% of SS4	Acres	% of SS4
10%	40,635	12%	41,666	12%	42,807	13%	43,792	13%

Stocking Rates, Age Class Distribution, and Pine Regeneration – Cumulative Effects

The Coyote and Wish timber sales increased merchantable volume growth rates and quality of timber. Commercial thinning conducted under these sales reduced stocking levels in some overstocked stands on suitable ground. Not all stands in the project area were treated, and growth has occurred, so there are currently many overstocked stands. An additional effect has been an increase in the quality of the timber through the removal of damaged, diseased, and poorly formed trees, but this has also resulted in those trees not being currently available for harvest. There has been an increase in individual tree growth by releasing the remaining trees from competition for light, water, and nutrients. Trees have developed larger diameters due to a reduction of competition. The number of mature trees available for future snags has decreased, and stand density reduction has decreased the probability of individual tree mortality. Some stands were regenerated, resulting in seedlings. A reduction of the risk of mountain pine beetle infestation due to reduction of stand density occurred, but risk is now increasing due to tree growth and regeneration.

Alternative 1 would not add to these effects on age class distribution, stocking level, or pine regeneration. In the absence of disturbance events, the area would continue to be dominated by stands 100 to 140 years old and stocking levels would increase.

Alternatives 2, 3, and 4 would add incrementally to effects on age class distribution by moving stands treated with overstory removal to younger age classes and promoting regeneration in shelterwood seedcut and group selection areas. Future uneven-age management entries at approximately 15-20 and 30-40 years would further diversify within-stand age class distribution. All proposed treatments would add to cumulative effects on stocking levels by decreasing stand density.

Alternatives 2, 3, and 4 may negatively affect some areas of pine regeneration through prescribed fire, but the additive effect of this and other projects would be a net increase in pine regeneration. These effects are consistent with Forest Plan Standards and Guidelines and would not exceed or approach any threshold.

Snags – Cumulative Effects

Past activities and events on NFS lands in the project area resulted in existing snag conditions. There are no other reasonably foreseeable projects in the project area that are expected to reduce existing snag densities. The potential change in snag density from the Coyote and Wish timber sales is expected to be low and inconsequential to snag density at both the project and Forest-wide scales. Since direct effects of the Moskee project and the Coyote and Wish sales on snags are expected to be minimal, cumulative effects on

existing snags are expected to be minimal.

The Coyote and Wish projects are also creating open forest conditions similar to this project. As a result, cumulative effects could result in even less snag recruitment in the future, which may lead to fewer snags in the future in the Moskee project area. This effect is not quantifiable for the project area.

According to the Phase 2 Amendment FEIS (USFS 2005), snag density and recruitment are not expected to be a problem at the Forest-wide scale as long as management actions contribute to meeting the overall MA structural stage objectives. As described above, none of the alternatives would substantially change Forest-wide structural stage percentages. The project would cause a small (one to two percentage points) movement away from objectives in two categories (4A in MAs 4.1 and 5.1) and a small (one percentage point) movement toward objectives in three categories (4B in MAs 4.1 and 5.1 and 4C in MA 4.1). Changes of this magnitude are not expected to affect the attainment of Objective 211 in the future.

Mountain Pine Beetle – Cumulative Effects

The cumulative effects boundary for mountain pine beetle includes the Riflepit timber sale, scheduled to run from 2006 through 2009. This sale is located immediately east of the Moskee project area in South Dakota. Mountain pine beetle infestation levels are high in some parts of this timber sale, which was initiated primarily to address existing infestation and risk of further infestation. Under Alternative 1, dense pine stands in much of the Moskee project area would continue to provide conditions capable of hosting epidemic beetle populations. The proximity of the infested area in South Dakota to the Moskee area may increase the likelihood of infestation. Actions to reduce risk of epidemic infestation are prescribed under the Forest Plan, so the cumulative effects of no action could exceed this threshold. Alternatives 2, 3, and 4 would decrease risk of infestation in the project area, adding to the effect of the Riflepit sale. This effect is consistent with Forest Plan Standards and Guidelines.

Rangeland

Rangeland – Affected Environment

Rangeland is defined in the Region 2 Rangeland Analysis and Management Training Guide as land producing or capable of producing native forage for grazing and browsing animals, and lands that have been revegetated naturally or artificially to provide a forage cover that is managed like native vegetation. It includes all grasslands, forblands, shrublands, and those forested lands which can – continually or periodically, naturally or through management – support an understory of herbaceous or shrubby vegetation that provides forage for grazing or browsing animals.

The Moskee project area includes most of the Lost Canyon Grazing Allotment and portions of the Grand Canyon, Silver Creek, Stearns Park, and Willow Springs Grazing Allotments (Table 26). All of the allotments except Lost Canyon are on the Rescission Act schedule for environmental analysis within the next two to three years.

Table 26. Grazing Allotments in the Project Area

Allotment name	Allotment acres	Allotment acres in project area
Lost Canyon	7,576	7,485
Grand Canyon	16,036	11,966
Silver Creek (Boardinghouse Unit)	3,560	765
Stearns Park	10,878	1,924
Willow Springs	11,986	1,608
Total	**50,036**	**23,748***

*Grand Canyon allotment includes private land, so the total allotment acres in the project area exceed NFS acres.

Rangeland – Direct/Indirect Effects

Impacts to the rangeland resources in the Moskee project area involve mainly riparian, grassland, and meadow communities. Not only are these communities important habitat for many wildlife and plant species, they are key to forage production for wildlife and livestock and are considered primary range. The Moskee project may affect quality and quantity of these areas. The availability of forage in these areas as well as their proximity to water makes them sensitive to management practices.

Road construction, closure, and decommissioning may impact the use of available forage by livestock as well as maintenance of the range improvements necessary for proper livestock management. None of the alternative proposes additional structural range improvements.

Alternative 1 (No Action): Under Alternative 1, no new Federal actions would occur this planning cycle. Ongoing activities, such as road maintenance, noxious weed treatment, and the Coyote and Wish timber sales would continue.

Large, contiguous, mature stands of timber, which are common in the project area, are vulnerable to wildfire and beetle infestation. Both would affect herbaceous plant communities and available forage for livestock and wildlife. As the canopy opens up due to tree mortality, the grass/forb component would receive more sunlight and moisture, increasing the vigor and health of these communities. At the same time, noxious weed infestations could increase. Downed trees could limit access to forage. An increase in downed timber from beetle kill would increase the risk of stand-replacing wildfires that could create tens to hundreds of acres of bare ground on which weeds could establish and compete with more desirable species (see Noxious Weeds section below).

This alternative would allow continued encroachment of ponderosa pine on primary range in areas outside of the Coyote and Wish timber sales. As trees mature and canopy cover and needle-cast increase, health and vigor of grass/forb communities may decrease as light available for photosynthesis is reduced. Encroachment of ponderosa pine into grassland communities, meadows, and riparian areas increases the grazing pressure on these areas as they shrink in size. This would ultimately reduce their capability under the current permitted livestock numbers. Allowable use Guidelines for forage described in the Forest Plan (page II-29) may eventually be exceeded, making it difficult to maintain satisfactory condition in some areas.

Alternatives 2, 3, and 4: Removal of timber through commercial and non-commercial treatment would provide transitory range (an area that temporarily produces an increase

in rangeland vegetation). These areas occur when the tree and shrub overstory are removed, allowing the grass/forb component more sunlight and moisture. This would be expected to improve the quality and quantity of the forage available to livestock. Distribution of livestock in the project area would improve as treatment areas are opened up and roads are improved or new ones are built, as long as water is available. The impacts from livestock on primary range, mostly located in meadows, upland grasslands, and riparian areas, would be expected to lessen as cattle distribute throughout the transitory range. This would aid in maintaining or moving these communities towards desired condition. With early coordination between district range and timber staffs, impacts on livestock operations would be minimized to the extent feasible. Alternatives 3 would have the greatest impact on rangelands because it has the greatest potential for increasing herbaceous plant communities and increasing available forage for livestock and wildlife through the treatment of 13,397 acres. Alternatives 2 and 4 would have somewhat less effect through treatment of 8,253 and 10,609 acres, respectively.

The maintenance of meadows and aspen communities through non-commercial treatments of pine encroaching on meadows and aspen stands would improve and help to maintain these important plant communities. These treatments are the same under Alternatives 3 and 4. Treatment of these areas is not proposed under Alternative 2.

Prescribed fire and mechanical fuel reduction proposed under all action alternatives would aid in maintaining or moving primary range towards satisfactory condition. These treatments would help maintain or restore upland grasslands and meadows by decreasing pine encroachment and increasing available forage. Prescribed fire would have a direct short-term impact on permittees and livestock grazing, since pasture rotations, season of use, or livestock numbers may need to be adjusted in order to allow sufficient recovery time in burned areas. New vegetation in burned areas often becomes very desirable to livestock and wildlife because of palatability and access. Forest Plan Guideline 4107 states that prescribed burn areas will be deferred from livestock grazing for a portion or all of the following growing season to ensure regrowth of forage. An interdisciplinary approach is taken to analyze the readiness of burned areas for grazing. With close coordination between district fuels/fire and range staffs, adequate time would be provided for vegetation to recover before grazing occurs while minimally impacting livestock permittee operations. Alternative 3 has the greatest potential to affect rangelands through prescribed burning of 3,630 acres and maintenance burning of an additional 2,820 acres. Alternative 4 would burn 75 percent fewer acres than Alternative 3 and would therefore be expected to result in fewer effects on rangeland. Amount of burning proposed under Alternative 2, and resulting effects, would be midway between Alternatives 3 and 4. Long-term maintenance of treatments such as pine removal from meadows and burn areas would improve distribution and continue to relieve pressure on primary grazing areas.

Road work would be coordinated with grazing permittee access needs. Permittees need access to maintain improvements such as fences and water developments and to manage livestock grazing, which normally occurs between June 11 and October 15. Improvements are often accessed via unclassified roads that could be closed for all or part of the year with administrative access given to the permittees. All roads help to facilitate livestock movement and aid in distribution across the rangeland.

Road construction has a direct impact on vegetation by removing it, and can indirectly increase noxious weeds that reduce the function and value of rangelands. Noxious weeds often outcompete desirable rangeland vegetation. Alternatives 3 and 4 have the greatest potential for soil disturbance. Alternative 2 has the most miles of construction, but Alternatives 3 and 4 have more miles of reconstruction. Actual acres disturbed are likely to be greatest under Alternatives 3 and 4, which would therefore be expected to have the greatest potential to impact rangeland through the introduction or spread of noxious weeds.

Rangeland – Cumulative Effects

The cumulative effects area for rangeland is the Moskee project area plus the Grand Canyon, Lost Canyon, Silver Creek (Boardinghouse Unit), Stearns Park, and Willow Springs Allotments. The time span for the cumulative effects analysis of rangeland is five to 10 years. These spatial and temporal boundaries were chosen for the rangeland cumulative effects analysis because grazing is an ongoing activity in these four allotments that overlap the Moskee project area.

Past, present, and reasonably foreseeable activities include livestock grazing, timber harvest, prescribed fire, wildfires, road construction, and land exchange. The Coyote, Wish, and Riflepit timber sales, post-sale activities, and recent prescribed burns have created and continue to create transitory range, increasing livestock distribution and available forage. This is expected to reduce the time livestock spend on primary range, helping to meet Forest Plan Objectives 301 and 302 as well as Guideline 2505. Transitory range lasts only as long as it takes for regeneration of trees and increased canopy cover, usually five to 10 years.

Most of the parcels considered for acquisition as part of the Moskee land exchange are meadows. Acquisition of parcels that are not already included in grazing allotments would increase primary grazing area. NFS parcels proposed for exchange are primarily forested and used as transitory range. Proposed actions, in combination with the potential exchange, would increase the overall area available as primary and transitory range.

All of the proposed activities discussed are limited in intensity and duration; any negative impacts would be minimal and directly related to livestock management in the short term. Impacts resulting from increased weed infestation are discussed below in the Noxious Weeds section.

Wildlife

This section documents what is currently known regarding wildlife and habitat resources in the Moskee project area on the Bearlodge Ranger District and analyzes the potential effects of the proposed action and alternatives. Data in this section were compiled from field surveys, Bearlodge District wildlife observation data, Rocky Mountain Bird Observatory (RMBO) surveys, Wyoming Natural Diversity Database records (2005), Atlas of Birds, Mammals, Reptiles and Amphibians in Wyoming (Cerovski et al. 2004), literature reviews, communication with district personnel, and the Biological Assessments/Biological Evaluations completed for the Forest Plan Revision and the Phase 2 Forest Plan Amendment (USFS 1996, 2005).

Wildlife Surveys

Surveys were conducted in the Moskee project area during the summers of 2005 and 2006. Breeding bird surveys were conducted by Forest Service biologists and the Wyoming Chapter of the Audubon Society in June 2006. Additional surveying was conducted in areas of high-potential habitat for the northern goshawk. High-potential habitat was identified using aerial photographs, the forest vegetation database, pertinent literature, local knowledge, and field reconnaissance. Goshawk surveys followed the Southwestern Region Goshawk Inventory Protocol (Lloyd 1992). Frest and Johannes (1993, 2000, and 2002) conducted surveys for sensitive snail species in this area. Surveys for other sensitive wildlife species and/or species of concern were conducted in conjunction with goshawk and rangeland surveys.

A variety of wildlife species use the Moskee project area. Species documented in the project area include sensitive species such as goshawk, northern leopard frog, Black Hills redbelly snake, and Cooper's Rocky Mountain snail. Federally protected species such as bald eagles have been documented within one-half mile of the project area. Some of the wildlife species found in the area include Rocky Mountain elk, white-tailed deer, mule deer, coyote, red fox, short-tailed weasel, raccoon, porcupine, cottontail rabbit, red squirrel, least chipmunk, red-backed vole, golden eagle, Merriam's turkey, great horned owl, ruffed grouse, red-breasted and white-breasted nuthatch, brown creeper, red crossbill, ovenbird, black-capped chickadee, American robin, gray jay, red-naped sapsucker, hairy woodpecker, white-winged junco, pine siskin, boreal chorus frog, smooth green snake, and various fritillary and crescent butterfly species. Secretive species such as mountain lion, northern flying squirrel, and Cooper's and sharp-shinned hawks also inhabit the project area.

Wildlife Habitat Components – Affected Environment

Grassland Communities

Approximately eight percent of the project area (1,815 acres) is in natural openings, meadows, and riparian grasslands. Grasslands and meadows provide unique habitats not found elsewhere within the forested ecosystem. Many of these meadows are being encroached upon by adjacent ponderosa pine and in some cases bur oak and aspen.

Hardwood Communities

Approximately 11 percent (2,570 acres) of the project area is forested with hardwoods. According to the forest vegetation database, there are 2,474 acres of aspen, 48 acres of paper birch, and 48 acres of bur oak. In addition, numerous mixed pine/hardwood stands typed as ponderosa pine support a substantial amount of aspen and, to a lesser extent, birch and oak. Some hardwood stands have undergone pine removal. Other stands are being encroached by pine. One objective of the Forest Plan is to maintain or enhance hardwood habitats to promote diversity in forest composition.

Snags

See Forest Vegetation section (page 66).

Late-Succession Forest

There are 966 acres of verified structural stage 5 (late-successional forest) in the project area. These pine stands exhibit late-succession characteristics such as a large trees (average diameter of trees over nine inches DBH is at least 16 inches DBH) and overstory age of at least 160 years. These stands make up a little over five percent of the pine stands in the project area. There are also 2,400 acres classified as SS 4C (mature stands with canopy closure greater than 70 percent). Many of these stands exhibit some late-successional characteristics. Ground reconnaissance of the area suggests the amount of late-successional pine may be underestimated. These stands provide nesting habitat for goshawks, thermal cover for deer and elk, and habitat for many other species that prefer dense, closed-canopy conditions.

Riparian/Aquatic Communities

Surface water and riparian habitat in the Moskee project area are limited (see Water Resources section, page 46). Forest succession, fire suppression, road location, loss of beaver, past livestock over-utilization, and water diversion have contributed to degradation of riparian habitat in the project area. Ponderosa pine has encroached on meadows and hardwood habitats in much of the project area. This encroachment has decreased the quality and quantity of riparian grassland and shrubland habitat. Evidence of historic beaver dams can be seen in the project area, but due to lack of water, there is currently no suitable habitat for beaver. Water diversions have eliminated some riparian habitats. Other springs that are not protected from livestock have been heavily used by cattle.

Wildlife Habitat Components – Direct/Indirect Effects

Grassland Communities

Alternative 1 (No Action): Under Alternative 1, meadow habitat that has become overgrown with pine would remain forested. Grassland communities would continue to decline in the absence of disturbance events.

Alternatives 2, 3, and 4: Encroachment of meadow habitat by pine would be expected to continue under Alternative 2, except where prescribed burning would set back succession in grassland areas. Alternatives 3 and 4 include prescribed burning and propose removal of non-commercial pine from about 1,178 acres of grassland habitat. These treatments would positively affect grassland communities.

Hardwood Communities

Alternative 1 (No Action): Under Alternative 1, pine would continue to encroach on hardwood stands. Hardwood communities would continue to decline in the absence of disturbance events.

Alternatives 2, 3, and 4: Alternatives 3 and 4 propose removal of non-commercial pine from about 1,000 acres of aspen, and Alternatives 2, 3, and 4 include prescribed burning. These activities would set back succession in hardwood communities. The Adams prescribed burns, located in the Moskee area and conducted between 2002 and 2005, stimulated growth of aspen.

Snags

See Forest Vegetation section (page 69).

Late-Succession Forest

Alternative 1 (No Action): Alternative 1 would have no effect on the 966 acres of late-succession forest or 2,368 acres of other dense, mature pine stands (structural stage 4C).

Alternatives 2, 3, and 4: Alternatives 2, 3, and 4 would have no effect on the 966 acres of late-succession forest, but would decrease 4C by nearly 75 percent as a result of treatments designed to reduce fire hazard and risk of mountain pine beetle infestation.

Riparian/Aquatic Communities

Alternative 1 (No Action): Alternative 1 would not affect riparian communities. Existing impacts from roads, grazing, and past timber harvesting may persist.

Alternatives 2, 3, and 4: Under Alternatives 2, 3, and 4, direct impacts to riparian and wetland ecosystems would most likely occur if these ecosystems are disturbed by timber harvesting or road-related activities (such as stream crossings or placement of fill). Riparian and wetland ecosystems within the project area are primarily associated with perennial drainages and spring systems. Most of the spring systems have been altered by water developments, and proposed activities would have little further effect. No commercial treatments, precommercial thinning, or prescribed burning are proposed under any alternative in the water influence zone along Cold Springs Creek, which appears to be the only perennial stream in the project area. Activities in other water influence zones would be conducted in accordance with WCP Handbook Management Measures 3, 9, 10, and 11 to ensure that riparian areas and wetlands are not adversely affected and that long-term stream health is maintained.

Wildlife Habitat Components – Cumulative Effects

The cumulative effects boundary for grassland communities, hardwood communities, snags, and late-succession forest is NFS lands within the project area boundary, because direct and indirect effects of the project would not be discernable beyond this area. The cumulative effects boundary for riparian/aquatic habitat is the 7th-level watersheds overlapping the project area, including all ownerships (approximately 54,545 acres). This area was selected for analysis because activities upstream of the project area may affect aquatic habitats in the project area.

The time span for the cumulative effects analysis of wildlife habitat components is from 1990 to 2017 to account for past activities that are still affecting these components and completion of all activities included in the Moskee proposals.

Grassland Communities

Succession has resulted in expansion of pine forest into meadows. The Bald-Carnegie prescribed burns conducted between 2002 and 2005 reduced pine encroachment of meadows in the northern part of the Moskee project area. Most of the parcels considered for acquisition in the Moskee land exchange are meadow, while most of the NFS lands considered for exchange are forested.

Alternative 1 (No Action): Alternative 1 would add to cumulative effects of forest succession by allowing pine to continue to expand. If the Moskee land exchange is completed, NFS grassland habitat would increase under all alternatives.

Alternatives 2, 3, and 4: Alternative 2 would work against the trend of forestation by prescribed burning, including on meadow edges. Removal of non-commercial pine from 1,178 acres of meadow as proposed under Alternatives 3 and 4, plus prescribed burning, would further counteract pine expansion. Alternatives 2, 3, and 4 would contribute toward achievement of Forest Plan Objective 205.

Hardwood Communities

Succession has resulted in expansion of pine forest into stands of hardwoods, particularly aspen. Coyote and Wish timber sales addressed this by removing pine from 66 acres of aspen. Coyote timber sale is scheduled to remove pine from 37 additional acres of aspen, and Wish post-sale activities include regeneration of 18 acres of aspen. The Adams prescribed burns (2002-2005) reduced competition with pine in hardwood areas.

Alternative 1 (No Action): Alternative 1 would add to cumulative effects of forest succession by allowing pine to continue to expand into aspen stands.

Alternatives 2, 3, and 4: Prescribed fire proposed under Alternatives 2, 3, and 4 would move conditions away from the cumulative effect of pine expansion. Alternatives 3 and 4 would further counteract the cumulative effect of succession by removing non-commercial pine from approximately 1,000 acres of aspen. Alternatives 2, 3, and 4 would contribute toward achievement of Forest Plan Objective 201.

Snags

The Coyote and Wish timber sales increased tree growth rates. Trees have developed larger diameters due to a reduction of competition. The number of mature trees available for future snags has decreased, and stand density reduction has decreased the probability of individual tree mortality.

Alternative 1 (No Action): Continuation of these sales under Alternative 1 would add to these effects.

Alternatives 2, 3, and 4: Removal of mature trees proposed under Alternatives 2, 3, and 4 would also add to cumulative effects on snags, as fewer mature trees would be available for development into large-diameter snags and reduction of stand density would further decrease probability of individual tree mortality. The cumulative effect of Alternative 4 would probably be less than Alternative 2 or 3 due to reduced acreage of overstory removal. Continued domination of the project area by mature structural stages, however, indicates that none of the alternatives would make presence of mature trees a limiting factor in future availability of snags. Given existing snag densities and large numbers of mature trees that would remain, none of the alternatives would be expected to affect achievement of Forest Plan Objective 211.

Late-Succession Forest

Coyote and Wish timber sales have not affected late-succession forest. They have thinned about 50 acres of other mature, dense forest. Other past activities considered in this

analysis have not affected late-succession or mature, dense forest. No late-succession stands are proposed for inclusion in the Moskee land exchange.

Alternative 1 (No Action): Under Alternative 1, Coyote timber sale would thin approximately 288 acres of mature, dense forest. This would add to the cumulative effect of reduced stand density, though density of untreated stands would be expected to continue to increase.

Alternatives 2, 3, and 4: Alternatives 2, 3, and 4 would not affect existing late-succession forest, but would add to the cumulative effect of an overall decrease in acreage of mature, dense pine stands. This would contribute toward achievement of Forest Plan Objectives 4.1-203 and 5.1-204.

Riparian/Aquatic Communities

Alternative 1 (No Action): Under Alternative 1, existing roads with disturbed areas connected to drainages would be expected to continue to contribute sediment to the drainage network. Sediment delivery rates from damaged or poorly designed roads may persist. The Riflepit project, which is located in the upper reaches of two 7th-level watersheds that also contain parts of the Moskee project area, includes timber harvest, fuel reduction, road improvements, and road closures. The Riflepit EA (USFS 2004a) concluded that these activities, conducted in accordance with Forest Plan and WCP Handbook direction, would not affect riparian areas, and that effects on the drainage network would not be expected to be discernable downstream in the Moskee project area. Ongoing Coyote and Wish timber sale activities will take place in water influence zones along intermittent streams. Application of WCPH design criteria to these activities is expected to maintain long-term stream health and riparian ecosystem condition.

Revision of grazing management plans for allotments in the project area is scheduled for 2008 and may modify use to achieve desired range conditions and Forest Plan Objectives.

Several parcels considered for acquisition as part of the Moskee land exchange include drainages with evidence of historic beaver dams. These drainages currently have little surface water or riparian habitat. Acquisition of these lands would result in the potential for improvement and expansion of riparian habitat in the project area. This effect would be equal under all alternatives.

Alternatives 2, 3, and 4: Alternatives 2, 3, and 4 would not affect the water influence zone along Cold Springs Creek. Activities proposed in other water influence zones, conducted in accordance with WCP Handbook Management Measures 3, 9, 10, and 11, would not be expected to degrade long-term stream health or riparian ecosystem condition. Therefore, these alternatives would not be expected to add to cumulative effects on riparian or aquatic communities.

Management Indicator Species

Management indicator species (MIS) can be used to indicate the welfare of other species with similar habitat needs. These species are designated as surrogates for other species with similar life histories or habitat requirements in order to assess the effects of management activities. Associations of vertebrate species related primarily to grass/forb/shrub stage (early-succession forest) or mature and old growth stages (late-

succession forest) were selected for analysis.

Table 27 lists MIS for the Forest, as provided in the Forest Plan and modified by the Phase 2 Amendment. Each species was evaluated for its potential to be affected by the proposed project. Species without suitable habitat present in the project area were not evaluated further.

Table 27: Management Indicator Species

Species	Known to Occur in Project Area?	Habitat Represented	Habitat Present in Project Area?	Analyzed in This Document?	Rationale for Not Analyzing Effects in This Document
Black-backed woodpecker *(Picoides articus)*	Yes	Closed pine canopy, tree cavities	Yes	Yes	
Brown creeper *(Certhia americana)*	Yes	Ponderosa pine late seral stages, tree cavities	Yes	Yes	
White-tailed deer *(Odocoileus virginianus)*	Yes	Early-succession pine	Yes	Yes	
Ruffed grouse *(Bonasa umbellus)*	Yes	Aspen forest	Yes	Yes	
Mountain sucker *(Catostomus platyrhynchus)*	No	Cold water aquatic habitats	No	No	No represented habitat in project area
Beaver *(Castor canadensis)*	No	Riparian and hardwoods	No	No	No represented habitat in project area
Golden-crowned kinglet *(Regulus satrapa)*	No	White spruce forest	No	No	No represented habitat in project area
Song sparrow *(Melospiza melodia)*	Yes	Riparian	Yes	Yes	
Grasshopper sparrow *(Ammodramus savannarum)*	No	Grasslands	No	No	No represented habitat in project area

Black-backed Woodpecker – Affected Environment

The black-backed woodpecker is associated with montane coniferous forests, primarily spruce and fir (Anderson 2003, Bent 1939). They also inhabit ponderosa pine (Dykstra et al. 1999) and lodgepole pine (Clark et al. 1989) forests. In northwestern Montana, Weydemeyer and Weydemeyer (1928) found this species to be more abundant in woods that have been logged or burned. In the Black Hills, Dykstra et al. (1999) also observed more black-backed woodpeckers in harvested stands compared to unharvested stands. The authors suggest an increased abundance of woody debris provided foraging sites for this species. A recent study in the Black Hills (Mohren and Anderson 2001) suggests black-backed woodpeckers are found in both immature and mature ponderosa pine stands with high (at least 60 percent) canopy cover. They are primary cavity nesters, tied to stand-replacing events such as insect outbreaks or large wildfires.

In the Black Hills, black-backed woodpeckers are highly associated with ponderosa pine forests that have been burned within the last five years or have high bark beetle populations. Another important habitat for this woodpecker is healthy ponderosa pine forests that have dense, mature or late-successional structure (SS 4C and 5). This third habitat type is especially important when recently burned areas and high beetle populations are not available (USFS 2006a).

At least 25,743 acres of unsalvaged pine burned recently by stand-replacing fires exists across the National Forest, and are available habitat for black-backed woodpeckers (USFS 2006a, 2007a). This is approximately 2.5 times greater than the 10,000 acres called for under Forest Plan Objective 11-03. Bark beetle infestations continue in many locations across the Forest, including sites adjacent to the project area. There are 2,400 acres of SS 4C, 966 acres of SS 5, and approximately 35 acres burned by stand-replacing fire in the last five years in the project area. Snag density exceeds the minimum levels specified by Objective 211.

The "Monitoring the Birds of the Black Hills" program was designed to statistically detect population trends over a longer time period than the five years that it has been implemented. Natural variability in the data and other factors preclude a short-term, meaningful analysis. A less rigorous population trend analysis, however, reveals a notable increase and subsequent decrease in black-backed woodpecker densities over the past five years in burned habitat. This pattern of rapid colonization and subsequent decline is consistent with findings of other studies (Anderson 2003), and is not a cause for alarm.

This species has been documented in the Moskee project area.

Black-backed Woodpecker – Direct/Indirect Effects

Alternative 1 (No Action): Alternative 1 would have no immediate effects on black-backed woodpecker, but would be expected to increase potential habitat over time as stand density and risk of mountain pine beetle infestation increase. Fire hazard would be highest under this alternative; any wildfires would further improve habitat. This alternative would be expected to maintain or enhance habitat in accordance with Objective 221.

Alternatives 2, 3, and 4: Alternative 2 would not affect existing burned areas or late-succession stands. Individual woodpeckers could be affected if occupied nest trees are cut. Potential for beetle infestation and stand-replacing wildfire would be expected to decrease. Structural stage 4C stands, currently 13 percent of the project area pine acres, would decrease to five percent. This would decrease habitat available for this species if burned or infested forest is not present. Incidental cutting of snags for safety reasons would not be expected to substantially reduce snag densities across the project area.

Effects of Alternatives 3 and 4 would be similar to those of Alternative 2. Structural stage 4C stands would decrease to four percent of the pine acres.

Black-backed Woodpecker – Cumulative Effects

The cumulative effects analysis area for black-backed woodpecker is the project area plus a one-mile buffer (approximately 52,000 acres). This area is selected because fire and

beetle infestation in pine stands are the main factors in this woodpecker's habitat, and fires or infestations adjacent to the project area could affect the project area and vice versa.

The Coyote, Wish, Riflepit, and Pit timber sales have not cut any burned stands and have had little effect on this aspect of potential black-backed woodpecker habitat, other than a reduction in the potential for stand-replacing wildfire. All of these projects are reducing risk of beetle infestation. The Adams and Bald-Carnegie prescribed burns resulted in a small increase in preferred habitat. The 2005 Cement Fire burned 1,100 acres in the cumulative effects area. Ninety percent of this was on NFS lands, where no salvage of burned timber has taken place. Salvage has taken place on non-NFS lands. The potential Moskee land exchange does not propose trading of any burned or infested stands.

Alternative 1 (No Action): This alternative would not add to effects of wildfire, prescribed fire, or timber harvest.

Alternatives 2, 3, and 4: These alternatives would add to the effects of prescribed fire and timber harvest by continuing to reduce fire hazard and risk of beetle infestation. Objective 11-03 regarding burned areas is currently being met across the Forest. None of the alternatives would affect achievement of this objective.

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 disturbances such as wildfire and beetle infestation. Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that black-backed woodpecker is likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives. Alternatives 2, 3, and 4 would contribute toward achievement of Forest Plan Objectives 221 and 238b by conserving existing preferred habitat (burned areas). They would decrease the potential for formation of additional preferred habitat by reducing fire hazard and risk of beetle infestation. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Brown Creeper – Affected Environment

The brown creeper 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-succession forest and snags. Forest characteristics preferred by creepers include large, unfragmented, mature, and old-growth stands with high canopy coverage and high densities of large trees and snags (Hejl et al. 2002).

Five years of RMBO data suggest the brown creeper is well distributed throughout the Black Hills (USFS 2006a). Overall, the species occurs in low densities across the Forest, but is most abundant in late-succession pine forests and white spruce habitats. Populations across the Forest have varied over the last five years of monitoring, with no obvious trend. Habitat trend appears to be stable, with a less than one percent decrease documented in the last 11 years (USFS 2006a).

This species has been documented in the Moskee project area. Preferred habitat in the form of pine SS 4C and 5 occurs on 3,366 acres (15 percent of NFS lands in the project area). There is no spruce in the project area.

Brown Creeper – Direct/Indirect Effects

Alternative 1 (No Action): There would be no direct effects because no new activities would occur. Potential indirect effects include an increase in nesting and foraging habitat over time as forest matures and becomes denser. Snag habitat would not be impacted. This alternative is likely to be the most beneficial for brown creepers. Risk of a stand-replacing wildfire would be highest under this alternative, and such an event would reduce habitat suitability for this species (Kotliar et al. 2002).

Alternatives 2, 3, and 4: These alternatives would comply with Forest Plan direction and contribute toward achievement of Objective 238a. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Under Alternatives 2, 3, and 4, proposed treatments would reduce acreage of dense, mature pine stands (see Table 28). Suitability of treated areas for brown creeper would decrease. Inadvertent loss of some individual birds or nests is possible under Alternatives 2, 3, and 4 if active nests are present in treated areas. Removal of mature trees in treatment units may decrease the availability of nesting trees. This effect may be most likely to occur under Alternative 3, which proposes commercial timber harvesting in the most SS 4C stands. Under all action alternatives, cutting of snags would generally be prohibited except to protect worker safety. For further discussion of effects on snags, see page 69.

Table 28: Potential Impacts on Brown Creeper Habitat

	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Acres	%	Acres	%	Acres	%	Acres	%
Preferred Habitat	3,366	100	1,812	54	1,623	48	1,627	48
Decrease in preferred habitat	0	0	1,554	46	1,743	52	1,739	52
Potential Impact least (1)-greatest (4)	1		2		4		3	

Brown Creeper – Cumulative Effects

The cumulative effects analysis area for brown creeper is ponderosa pine habitat in the project area (18,107 acres). This area is selected because brown creepers are associated with pine and spruce in the Black Hills, and there is no spruce in the project area. The time span for the cumulative effects analysis is from 1990 to 2017 to account for past activities that are still affecting pine habitat and completion of all activities included in the Moskee proposals.

The Coyote and Wish timber sales reduced pine stand density on 655 acres, though no SS 4C or 5 stands were treated (USFS 1998). Remaining timber harvesting in the Coyote and Wish timber sales (1,135 acres) will not occur in SS 4C or 5 stands. These actions did not affect existing brown creeper habitat, but reduced density or set back succession in moderately dense, mature stands that could have developed into SS 4C or 5. The Adams and Bald-Carnegie prescribed burns took place primarily in stands that already had low to moderate density, so effects on brown creeper habitat were minimal. The potential Moskee land exchange would not trade any late-succession stands.

Alternative 1 (No Action): Alternative 1 would not add to these cumulative effects. Forest succession and stand density would continue to increase in the absence of

disturbance events.

Alternatives 2, 3, and 4: These alternatives would add to cumulative effects by decreasing density of preferred brown creeper habitat. While acreage of SS 4C stands would decrease across the project area, Alternatives 2, 3, and 4 would contribute toward achievement of Forest-wide Objective 238a by moving structural stage distribution toward the desired distribution across the management area.

Brown creeper 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 and snags. Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that brown creepers are likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives. All action alternatives would comply with Forest Plan direction and contribute toward achievement of Objective 238a. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

White-tailed Deer – Affected Environment

In the Black Hills, white-tailed deer inhabit a variety of forest types and structural stages. The Forest Plan, as amended, designated the white-tailed deer as an MIS for early-succession ponderosa pine forests. The Black Hills white-tailed deer population increased between 2000 and 2004 (USFS 2007a). Harvest statistics and Wyoming Game and Fish Department observations suggest that white-tailed deer populations dropped in 2004, but rebounded in 2005. Modeling indicated that the 2005 post-hunting season population was 36,917 animals, slightly below the state objective, but the model may not produce reliable estimates (Sandrini 2006). Forest-wide summer habitat trend is upward, and winter habitat trend is stable to slightly downward. The Forest is almost fully meeting Objective 217. The Forest is meeting Objective 238a with respect to summer habitat. Winter habitat may be declining slightly (USFS 2007a).

White-tailed deer in the Black Hills migrate between distinct summer and winter ranges. The Moskee project area is primarily used by white-tailed deer during the spring, summer, and fall. White-tailed deer are very common in the project area, and their preferred summer aspen habitat is well represented within the project area (2,474 acres).

Forage production can be increased through prescribed burning, thinning, and pine litter reduction (DePerno 1998; Hippensteel 2000). Prescribed burning of browse species such as chokecherry, serviceberry, and aspen can be beneficial since these species are prolific root or crown sprouters. Thinning ponderosa pine stands allows more light to reach the forest floor than in unthinned stands and increases forage production (Uresk and Severson 1998). In mixed oak-pine stands, selective removal of pine trees may enhance reproduction of oak and associated shrubs (Sieg and Severson 1996).

White-tailed Deer – Direct/Indirect Effects

Alternative 1 (No Action): Alternative 1 would have no direct effects because no new activities would occur. Potential indirect effects include forest succession that favors pine and contributes to loss of aspen. In the absence of disturbance events, preferred habitat would be expected to decrease under this alternative.

Alternatives 2, 3, and 4: These alternatives would increase preferred deer habitat by opening and regenerating pine stands and enhancing non-pine habitats through timber harvesting and prescribed burning. Alternatives 3 and 4 would further improve habitat by removing encroaching pine from 1,000 acres of aspen and 1,178 acres of meadow. Decreases in open road density would reduce the potential for disturbance of fawning, security, and foraging habitats. Alternative 3 may have the most positive effect on white-tailed deer by enhancing habitat on the most acres.

Table 29: Effects on Components of White-tailed Deer Habitat

Activities	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Open road density (mi./sq. mi.)	2.52	1.88	1.90	1.91
Enhancement of aspen habitat (acres)	0	0	1,000	1,000
Enhancement of meadow habitat (acres)	0	0	1,178	1,178
Increase in early-successional pine habitat (SS1, 2, 3) (acres)	0	1,248	2,178	2,001
Increase in open pine habitat (SS1, 3A, 4A) (acres)	0	4,187	4,836	4,736
Prescribed burning (acres)	0	3,911	6,348	1,661

White-tailed Deer – Cumulative Effects

The cumulative effects analysis area for white-tailed deer is the project area, which serves primarily as summer range, plus approximate migration routes and winter range (about 88,600 acres). Migration routes and winter range are located mainly outside the National Forest at lower elevations. This area is selected because deer are affected by conditions across their range. The time span for the cumulative effects analysis is from 1990 to 2047 to account for past activities that are still affecting habitat, completion of all activities included in the Moskee proposals, and future uneven-age management entries.

The Coyote and Wish timber sales reduced density of pine stands on 655 acres, removed pine from 48 acres of aspen, and regenerated 18 acres of aspen. These sales are scheduled to thin or regenerate pine on an additional 1,135 acres and remove pine from 37 acres of hardwoods in the project area. These actions, as well as 2,800 acres of prescribed burning, positively affect deer habitat by improving forage and fawning habitat.

Past, present, and foreseeable actions in winter range and along migration routes on private land are less well documented. Most of this land is currently managed for livestock production. No substantial changes to this management are known to be planned. Effects of livestock management on deer winter range can be assumed to depend primarily on stocking levels and precipitation. The Moskee land exchange proposal does not include any winter range or migration routes. Acquisition of open meadows may improve summer habitat or prevent loss of this habitat to subdivision and development.

Alternative 1 (No Action): Alternative 1 would not add to these cumulative effects. Forest succession and stand density would continue to increase in the absence of disturbance events.

Alternatives 2, 3, and 4: Alternatives 2, 3, and 4 would add to cumulative effects by decreasing density of pine stands and setting back succession. Alternatives 2, 3, and 4 would contribute toward achievement of Forest-wide Objectives 217and 238a by enhancing non-pine habitats and generally moving structural stage distribution toward the

desired distribution across the management area. Alternatives 3 and 4 would also contribute towards achievement of these objectives by diversifying within-stand structure.

White-tailed deer 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 early-succession forest. Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that deer are likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives. These alternatives would comply with Forest Plan direction. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Ruffed Grouse – Affected Environment

Ruffed grouse are classified by Wyoming and South Dakota state wildlife agencies as an upland game bird. There is an annual fall hunting season. Harvest data from the Wyoming Black Hills suggest ruffed grouse numbers are increasing (Sandrini 2005), though these data need to be viewed in light of the overall low ruffed grouse densities. While harvesting rates have fluctuated over the past few decades, and any trends or causes are not clear, years with high harvesting rates may reflect years with good brood production. Ruffed grouse densities vary over the range of the species in the State, and this probably is a function of habitat quality in local areas. Little is known about habitat selection or preference by the species in Wyoming, but young aspen and mixed aspen-conifer stands probably provide the best habitat. A new ruffed grouse monitoring protocol will be tested across the National Forest in 2007; the data collected through this protocol will serve as baseline data for Forest-wide trend assessments. Forest-wide habitat trend over the last 11 years is slightly downward (USFS 2007a).

Young aspen stands (SS 2 and 3) make up approximately 10 percent of the project area and 87 percent of the aspen acres in the project area. Young aspen provides broods with cover and display sites for breeding males. Although they do eat buds and fruits of other plants, research has shown that populations decline when aspen is removed, even if alternative food sources are plentiful. Some authors have indicated that conifers in close proximity to aspen stands are desirable for winter cover (DeGraaf et al. 1991).

Ruffed Grouse – Direct/Indirect Effects

Alternative 1 (No Action): There would be no direct effects because no new activities would occur. In the absence of disturbance events, forest succession that favors pine and contributes to loss of aspen would be expected to occur. Risk of stand-replacing wildfire and mountain pine beetle infestation would be highest under this alternative. Wildfire would have short-term (three- to five-year) negative effects, but long-term (five- to 50-year) beneficial effects by expanding and stimulating aspen stands. Beetle outbreaks would benefit grouse habitat by removing pine.

Alternatives 2, 3, and 4: These alternatives would benefit grouse habitat by thinning and regenerating pine, removing pine from aspen stands, and prescribed burning (Table 30). These activities may also have short-term (less than five-year) negative effects such as individual mortality, habitat loss, or disturbance. Alternative 3 would enhance conditions

for aspen on the largest area and may have the greatest beneficial effect on grouse.

Table 30: Effects on Components of Ruffed Grouse Habitat

Activities	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Enhancement of aspen habitat	0	0	1,000	1,000
Increase in open pine habitat (SS 1, 3A, 4A)	0	4,187	4,836	4,736
Prescribed burning	0	3,911	6,348	1,661

Ruffed Grouse – Cumulative Effects

The cumulative effects analysis area for ruffed grouse is NFS lands in the project area (22,570 acres). This area is selected because while ruffed grouse are primarily associated with aspen stands, many pine stands in the project area have an understory aspen component that may provide grouse habitat. The time span for the cumulative effects analysis is from 1990 to 2017 to account for past activities that are still affecting this habitat and completion of all activities included in the Moskee proposals.

The Coyote and Wish timber sales removed pine from 48 acres of aspen and regenerated 18 acres of aspen. Pine will be removed from an additional 37 acres of aspen under the Coyote sale. These actions, as well as 2,800 acres of prescribed burning (Bald-Carnegie and Adams), positively affected ruffed grouse habitat by enhancing aspen stand condition.

The potential Moskee land exchange does not include trading of any aspen stands.

Alternative 1 (No Action): Alternative 1 would not add to these cumulative effects. Forest succession to pine would continue in the absence of disturbance events.

Alternatives 2, 3, and 4: Alternatives 3 and 4 would add to cumulative effects by reducing pine competition with aspen. Alternatives 2, 3, and 4 would enhance conditions for understory hardwoods through pine stand density reduction and prescribed burning. These alternatives would contribute toward achievement of Forest-wide Objectives 217 and 238a by enhancing hardwood conditions.

Ruffed grouse 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 aspen habitat. Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that ruffed grouse are likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives, including hardwood restoration (Objective 201). All action alternatives would comply with Forest Plan direction. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Song Sparrow – Affected Environment

In the Black Hills, the song sparrow is strongly associated with riparian habitats (Panjabi 2007), which is the basis for its MIS status. It depends on willows and streamside thickets (Panjabi 2007). This species has been documented in the Moskee project area, although riparian habitat (particularly riparian shrub habitat) is extremely limited. The song sparrow is well distributed throughout the northern Black Hills and Bear Lodge

Mountains. Preliminary data suggest stable population trend and slightly upward habitat trend (USFS 2007a).

Song Sparrow – Direct/Indirect Effects

Alternative 1 (No Action): Alternative 1 would have no direct effects because no new activities would occur. Potential indirect effects include forest succession that favors pine and contributes to loss of riparian shrub communities. In the absence of disturbance events, preferred habitat may decrease under this alternative.

Alternatives 2, 3, and 4: These alternatives would have little effect on riparian habitat. Non-commercial pine removal from meadows proposed on 1,178 acres under Alternatives 3 and 4 would reduce pine competition with riparian shrubs. This may enhance habitat conditions for the song sparrow. Proposed road closure and decommissioning may reduce disturbance of habitat.

Song Sparrow – Cumulative Effects

The cumulative effects analysis area for song sparrow is riparian habitat on all ownerships in the project area. This habitat has not been quantified, but is estimated to occur on 110 to 150 acres based on GIS analysis. This area is selected because song sparrow is associated with riparian habitat, and much of this habitat in the project area is found on non-NFS lands that may be included in a future land exchange. The time span for the cumulative effects analysis is from 1990 to 2017 to account for past activities that are still affecting this habitat and completion of all activities included in the Moskee proposals.

The Coyote and Wish timber sales and Bald-Carnegie and Adams prescribed burns have had little effect on riparian shrub habitat. These projects took place or are taking place mostly in uplands and primarily in ponderosa pine stands. Ongoing activities such as water diversion and livestock grazing affect riparian areas more directly by modifying riparian shrub communities. Revision of grazing management plans for allotments in the project area is scheduled for 2008 and may modify use to achieve desired range conditions and Forest Plan Objectives. Many non-NFS parcels in the project area are also grazed and have few shrubs in riparian areas. Most of the parcels currently being considered for acquisition in the Moskee land exchange include riparian meadows with few shrubs. If these parcels become part of the National Forest system, application of Forest Plan Standards and WCPH direction to these riparian areas could result in improved habitat for song sparrows.

Alternative 1 (No Action): Alternative 1 would not add to cumulative effects described above.

Alternatives 2, 3, and 4: Because these alternatives may slightly improve riparian shrub habitat, they would not be expected to add to cumulative effects. All alternatives would contribute to achievement of Objectives 213 and 238a.

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 species that rely on riparian habitat. Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that song sparrow is likely to persist on

the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives. All action alternatives would comply with Forest Plan direction. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Species of Local Concern

Region 2 defines species of local concern (SOLC) as species documented or suspected to be at risk at a local scale within Region 2, but not meeting the criteria for regional sensitive species designation. Project design and analysis need to address SOLC. For the Moskee project, risk analyses were completed only for those species that occur in the project area or whose habitat occurs in the project area. Table 31 displays Black Hills National Forest SOLC.

Table 31: Wildlife Species of Local Concern

Species	Known to Occur in Project Area?	Suitable Habitat Present in Project Area?	Analyzed in This Document?	Rationale for Not Analyzing in This Document
Invertebrates				
Atlantis fritillary (*Speyeria atlantis pahasapa)*	No	No	No	Species and habitat not present.
Tawny crescent (*Phycoides batesii*)	Yes	Yes	Yes	
Callused vertigo (*Vertigo arthuri)*	Yes	Yes	Yes	
Mystery vertigo (*Vertigo paradoxa)*	Yes	Yes	Yes	
Frigid ambersnail (*Catinella gelida)*	No	No	No	Species and habitat not present.
Striate disc (*Discus shimekii)*	No	No	No	Species and habitat not present.
Birds				
Sharp-shinned hawk (*Accipiter striatus)*	Yes	Yes	Yes	
Cooper's hawk (*Accipiter cooperii)*	Yes	Yes	Yes	
Broad-winged hawk (*Buteo platypterus)*	No	Yes	Yes	
Northern saw-whet owl *(Aegolius acadicus)*	No	Yes	Yes	
Pygmy nuthatch (*Sitta pygmaea)*	No	Yes	Yes	
American dipper (*Cinclus mexicanus)*	No	No	No	Species and habitat not present.
Black-and-white warbler (*Mniotitla varia)*	No	Yes	Yes	
Mammals				
Northern myotis (*Myotis septentrionalis)*	No	Yes	Yes	
Small-footed myotis (*Myotis ciliolabrum)*	No	Yes	Yes	
Long-eared myotis (*Myotis evotis)*	No	Yes	Yes	
Long-legged myotis (*Myotis volans)*	No	Yes	Yes	
Northern flying squirrel (*Glaucomys sabrinus)*	No	Yes	Yes	

Species	Known to Occur in Project Area?	Suitable Habitat Present in Project Area?	Analyzed in This Document?	Rationale for Not Analyzing in This Document
Meadow jumping mouse (*Zapus hudsonius campestris)*	No	Yes	Yes	
Mountain goat (*Oreamnos americanus)*	No	No	No	Species and habitat not present.

Tawny Crescent – Affected Environment

The tawny crescent is a butterfly that occurs in all counties encompassing the Black Hills (Ferris 1971; Marrone 2002). It is found in open meadows, stream bottoms, roads, trails, and riparian woodlands (Stefanich 2001). It is also found in wet forest corridors across the ecotone between mixed-grass meadows or prairie grasslands and adjacent woodlands (Royer and Marrone 1992). Butterflies feed on a variety of forbs, including dogbane, leafy spurge, and various composite flowers. Tawny crescent larvae appear to depend on asters as a food source, although the specific host species and their relationship remain unclear (Stefanich 2001). Habitat trend appears to be slightly upward (USFS 2007a).

Tawny Crescent – Direct/Indirect Effects

Alternative 1 (No Action): Alternative 1 would have no direct effects because no new activities would occur. Potential indirect effects include forest succession that favors pine and contributes to loss of open meadows and hardwoods. In the absence of disturbance events, preferred habitat would be expected to decrease under this alternative.

Alternatives 2, 3, and 4: These alternatives could cause individual butterfly mortality due to management activities. Impacts are more likely to occur under Alternative 3 due to the larger area treated. One- to two-year habitat reduction or disturbance may occur due to logging, fuel reduction, thinning, prescribed burning, and roadwork in or near meadow areas. Proposed treatments would have mostly beneficial impacts by decreasing pine stand density. Non-commercial pine removal from meadows on 1,178 acres under Alternatives 3 and 4 would have especially beneficial effects on potential habitat. Prescribed burning may have negative impacts for one season, but would ultimately expand butterfly habitat.

Tawny Crescent – Cumulative Effects

The cumulative effects analysis area for tawny crescent is the project area. This area is selected because while tawny crescents are associated primarily with openings, they may be affected by actions that reduce forest density. The time span for the cumulative effects analysis is from 1990 to 2017 to account for past activities that are still affecting habitat and completion of all activities included in the Moskee proposals.

The Coyote and Wish timber sales reduced density of pine stands on 655 acres and are scheduled to thin or regenerate pine on an additional 1,135 acres. These actions, as well as 2,800 acres of prescribed burning, are likely to have a positive effect on tawny crescent habitat by enhancing conditions for understory forbs. Acquisition of open meadows proposed in the Moskee land exchange may improve meadow habitat or prevent loss of this habitat to subdivision and development.

Alternative 1 (No Action): Alternative 1 would not add to cumulative effects. Forest succession and stand density would continue to increase in the absence of disturbance events.

Alternatives 2, 3, and 4: These alternatives would add to cumulative effects by decreasing density of pine stands and setting back succession. Alternatives 2, 3, and 4 would contribute toward achievement of Forest-wide Objective 221 by enhancing non-pine habitats.

Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that tawny crescent is likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives. All action alternatives would comply with Forest Plan direction. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Callused Vertigo and Mystery Vertigo – Affected Environment

Habitat characteristics for these two snails are very similar. They are often found in the same colonies in wet, relatively undisturbed forest, primarily on northern aspects with deciduous litter (Frest and Johannes 2002). Essential habitat features include a limestone or schist substrate, shaded forest floor, organic surface litter, downed logs, and mesic site conditions. They are associated with spruce, pine, hardwood and riparian ecosystems. They are found in the central and northern Black Hills and the Bear Lodge Mountains. Sites 143 and 144 (Frest and Johannes 2002) are located in the project area. Mystery vertigo was documented at site 143, which is surrounded by a buck-and-rail fence to prevent livestock entry.

Callused Vertigo and Mystery Vertigo – Direct/Indirect Effects

Alternative 1 (No Action): There would be no direct impacts under Alternative 1 because no new activities would occur. Continued forest succession and pine encroachment could negatively affect snail habitat.

Alternatives 2, 3, and 4: These alternatives propose a fuel break along the main gravel road that is approximately 50 feet from site 143. Maintenance of this road, including blading and addition of spot gravel, would take place under all alternatives. These activities would take place within the road prism and would not be expected to affect the colony. The fuel break would be limited to the west side of the road in this location (the site is on the east side) so that no ground disturbance or reduction of canopy would take place within 150 feet of the site. No other vegetation management activities are proposed within 1,000 feet of the known colony. If unknown colonies occur within proposed treatment areas, individuals of this species could be affected. Unoccupied suitable habitats that occur within the treatment units may be altered by soil compaction, increased insolation, and alterations to the detrital layer. Exclusion of damp sites and deciduous forest from most treatments reduces the area of potential direct effects. Any colonies discovered during implementation would be protected with disturbance-free buffer zones.

Callused Vertigo and Mystery Vertigo – Cumulative Effects

The cumulative effects analysis area for callused vertigo and mystery vertigo is the project area. This area is selected because suitable habitat for these species occurs in various locations across the project area. The time span for the cumulative effects analysis is from 1990 to 2017 to account for past activities that are still affecting habitat and completion of all activities included in the Moskee proposals.

The Coyote and Wish timber sales have reduced density of pine stands on 655 acres and removed pine from 48 acres of aspen. These actions, as well as 2,800 acres of prescribed burning, did not affect known sites but could have negatively affected unknown colonies.

Alternative 1 (No Action): Under Alternative 1, the remaining activities related to the Coyote and Wish timber sales could add to cumulative effects. In untreated areas, forest succession and stand density would continue to increase in the absence of disturbance events. Lack of disturbance would maintain snail habitat; the potential for high-intensity wildfires that may have negative effects on snails and their habitat would be expected to increase.

Alternatives 2, 3, and 4: These alternatives could add to cumulative effects by decreasing density of pine stands and setting back succession. Because the known snail sites would not be affected, these alternatives would contribute toward achievement of Objective 221.

Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that these species are likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives. All action alternatives would comply with Forest Plan direction. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Sharp-shinned Hawk – Affected Environment

The sharp-shinned hawk occurs throughout the Black Hills, but it is perhaps the rarest of the accipiters on the Forest (USFS 2007a). Six sharp-shinned hawks were observed on transects in 2004, more than in any other year (Panjabi 2004). The sharp-shinned hawk breeds in dense forests throughout much of Canada and the United States (Udvardy and Ferrand 1994). In the Black Hills, sharp-shinned hawks were suggested to be "probably fairly common" (Pettingill and Whitney 1965), although currently they seem to occur in very low densities (Panjabi 2004). Sharp-shinned hawks have been documented using spruce, pine, and aspen cover types (Panjabi 2003). The 18 RMBO observations occurred in nearly all habitat types; there was no obvious preference for any one habitat (USFS 2007a). An association between nesting and young seral stages with dense canopies has been noted (Stephens and Anderson 2003). Preferred prey includes small birds and mammals. Sharp-shinned hawks have been documented on the Bearlodge District. There are currently 267 acres of young, dense to moderately dense forest (SS 3B and 3C), though stand data indicate another 4,700 acres of mature, dense to moderately dense forest (SS 4B or 4C) with pine seedling/sapling understory.

Sharp-shinned Hawk – Direct/Indirect Effects

Alternative 1 (No Action): There would be no direct impacts under Alternative 1 because no new activities would occur. Potential nesting habitat (SS 3B and 3C) would gradually decrease as stands mature. Potential severity and rate of wildfire spread would gradually increase. Wildfire would have negative impacts for five to10 years, but ultimately beneficial impacts by resulting in young, dense stands. An increase in mountain pine beetle infestation would be expected to improve sharp-shinned hawk foraging habitat by removing pine and increasing diversity.

Alternatives 2, 3, and 4: These alternatives could result in individual mortality due to nest loss or abandonment if birds are disturbed by nearby management activities. Forest Plan Standard 3204 would reduce this risk by protecting raptor nests. Alternative 2 would not affect existing SS 3C stands, while Alternatives 3 and 4 would decrease it by eight acres (11 percent). All action alternatives would appear to increase SS 3B, though this is due to reclassification of stands with existing understory after removal of the mature pine overstory. Potential nesting habitat in other stands would decrease for 5 to 10 years due to precommercial thinning, understory mulch, and shaded fuel breaks. This effect would be greatest under Alternative 4 and least under Alternative 2. At the same time, treatments that move stands toward younger structural stages (shelterwood seedcut and group selection) would set the stage for development of future potential nesting habitat. This effect would be greatest under Alternative 3 and least under Alternative 2.

Foraging habitat would be expected to increase, with timber harvesting, thinning, prescribed burning, and meadow/hardwood enhancement treatments providing a variety of structural stages and cover types for a diversity of prey species.

Table 32: Effects on Components of Sharp-shinned Hawk Habitat

Activities	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Precommercial thinning in potential nesting habitat	0	563	740	609
Understory mulch in potential nesting habitat	0	0	0	154
Shaded fuel breaks in potential nesting habitat	0	0	0	0
Total	*0*	*563*	*740*	*763*
Shelterwood seedcut or shelterwood seedcut/overstory removal	0	958	1,695	1,695
Group selection	0	0	286	586
Total	*0*	*958*	*1,981*	*2,281*

Sharp-shinned Hawk – Cumulative Effects

The cumulative effects analysis area for sharp-shinned hawk is NFS lands in the project area. This area is selected because suitable habitat for this species occurs in various locations across the project area and is not generally affected by events on non-NFS lands. The time span for the cumulative effects analysis is from 1990 to 2017 to account for past activities that are still affecting habitat and completion of all activities included in the Moskee proposals.

Ongoing precommercial thinning (312 acres) is reducing density of potential sharp-shinned hawk habitat. The recently completed 2,800 acres of prescribed burning reduced suitability of pockets of potential habitat, but did not take place in stands with large areas

of dense, young pine. The potential Moskee land exchange does not include any pine SS 3B or 3C stands.

Alternative 1 (No Action): Under Alternative 1, an additional 146 acres of precommercial thinning associated with the Coyote and Wish projects could add to this cumulative effect. In untreated areas, forest succession and stand density would continue to increase in the absence of disturbance events. Lack of disturbance would generally maintain potential nesting habitat and allow diversity of foraging habitat to decrease. Concurrently, the potential for intense wildfires that may have negative effects on nesting habitat would be expected to increase.

Alternatives 2, 3, and 4: These alternatives would be expected to add to cumulative effects for five to 10 years by decreasing density of young pine stands. Because most of the potential nesting habitat would remain and proposed regeneration harvesting would ultimately increase this habitat, these alternatives would contribute toward achievement of Objective 221. Future uneven-age management entries under Alternatives 3 and 4 would diversify within-stand structure and create patches of young forest.

Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that sharp-shinned hawk is likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives. All action alternatives would comply with Forest Plan direction. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Cooper's Hawk – Affected Environment

The Cooper's hawk appears to be distributed through most of the Black Hills and Bearlodge Mountains, though it is fairly uncommon (USFS 2007a). It typically nests in riparian, coniferous, and aspen forests, and will nest in ponderosa pine with moderate to high canopy closure (SS 4B, 4C and 5) adjacent to openings. The project area contains 9,493 acres of ponderosa pine in SS 4B, 4C, or 5; and 2,474 acres of aspen.

The Cooper's hawk forages across diverse habitats and preys on a variety of birds and mammals (Stephens and Anderson 2003), though few studies have investigated the foraging habitat of this species (Murphy et al. 1988). We know little of preferences for stands of differing densities, ages, tree sizes, or edge versus interior forests by Cooper's hawks (Reynolds 1989). They appear, however, to use available forests opportunistically if the available types are not too dense for flight below or within the canopy (Reynolds 1989).

There are 31 records of Cooper's hawks in the RMBO database and 22 in the NRIS fauna wildlife database. The RMBO program has recorded the species in all of the major habitat types, with no obvious affinity for any one. Cooper's hawks have been documented near the Moskee area, and two nests found in the project area are believed to be those of Cooper's hawks.

Cooper's Hawk – Direct/Indirect Effects

Alternative 1 (No Action): Alternative 1 would have no direct impacts because no new activities would occur. Habitat for this species would be expected to remain stable over

the next five to 10 years unless disturbed by fire or mountain pine beetle infestation. Continued forest succession may reduce habitat suitability beyond that time as aspen decreases and understory density increases.

Alternatives 2, 3, and 4: These alternatives could result in individual mortality due to nest loss or abandonment if birds are disturbed by nearby management activities. Application of Forest Plan Standard 3204 would reduce this risk by protecting raptor nests.

Alternatives 3 and 4 would be expected to enhance aspen habitat through removal of pine (1,000 acres). These alternatives would affect potential nesting habitat in pine through various silvicultural treatments that reduce stand density or regenerate pine. Thinning may increase suitability for Cooper's hawk if the existing canopy has become denser than this species prefers. Other treatments such as shelterwood seedcut would be expected to decrease suitability due to the open canopy of the resulting stand. Regeneration harvesting may also, however, enhance habitat by providing openings adjacent to stands that remain dense. The most acres of SS 4B/4C/5 would be treated under Alternative 3 and the fewest under Alternative 2, but actual effects would also depend on spatial arrangement of treatments. Foraging habitat for Cooper's hawk would remain stable or increase with logging, thinning, and prescribed burning. These treatments would provide a variety of prey in diverse habitats.

Table 33: Proposed Treatments that May Affect Preferred Cooper's Hawk Nesting Habitat

Treatment	Alternative			
	1	2	3	4
Commercial thinning	0	3,272	3,143	2,242
Shelterwood seedcut or seedcut/overstory removal	0	958	1,695	1,695
Pine removal from aspen	0	0	1,000	1,000

Cooper's Hawk – Cumulative Effects

The cumulative effects analysis area for Cooper's hawk is NFS lands in the project area. This area is selected because Cooper's hawk is associated with a variety of habitat types. The time span for the cumulative effects analysis is from 1990 to 2017 to account for past activities that are still affecting pine habitat and completion of all activities included in the Moskee proposals.

The Coyote and Wish timber sales reduced pine stand density on 655 acres, mainly in SS 4B stands (USFS 1998). These actions reduced density or set back succession in moderately dense, mature stands. These projects also removed pine from 66 acres of aspen, which had a beneficial effect on potential Cooper's hawk habitat by maintaining this cover type. The Adams and Bald-Carnegie prescribed burns took place primarily in stands with low to moderate density. Resulting reduction of understory pine and creation of small openings would be expected to increase habitat suitability for Cooper's hawk.

The remaining timber harvesting in Coyote and Wish (1,135 acres) will occur in SS 4A and 4B stands. Treatments in SS 4B would be expected to add to cumulative effects.

The potential Moskee land exchange does not include any aspen or late-succession forest.

Alternative 1 (No Action): Under Alternative 1, forest succession and stand density would continue to increase in the absence of disturbance events. Foraging habitat could decrease in diversity over time, and suitability of stands for nesting may decrease as density increases.

Alternatives 2, 3, and 4: These alternatives would add to cumulative effects by decreasing density of potential Cooper's hawk nesting habitat in pine and burning understory vegetation. Alternatives 3 and 4 would enhance potential habitat in aspen through 1,000 acres of pine removal. Alternatives 2, 3, and 4 would contribute toward achievement of Forest-wide Objective 221 by creating openings, enhancing aspen, and reducing understory density.

Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that Cooper's hawk is likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives. All action alternatives would comply with Forest Plan direction. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Broad-winged Hawk – Affected Environment

The broad-winged hawk breeds in deciduous and coniferous forests from southern Canada south throughout the eastern United States (Bull and Ferrand 1977). These hawks winter in tropical South America (Bull and Ferrand 1977) and forage primarily in mature to old-growth forests, along forest streams, roads and openings (Stephens and Anderson 2003a). They feed on a variety of prey, including amphibians, reptiles, insects, birds, and small mammals (Stephens and Anderson 2003a). Panjabi (2003) suggested late-successional pine stands might also be important nesting habitat (SS 5).

In the Black Hills, the broad-winged hawk is found primarily to the northern hills and Bear Lodge Mountains. It has been reported 52 times through the RMBO program (USFS 2007a), and there are three additional records in the NRIS Fauna wildlife database. Most (43 out of 52) of the RMBO detections occurred in 2004 or 2005. The RMBO observations have occurred most frequently in aspen (14), riparian (13), and late-succession pine habitats (13), indicating that a deciduous tree component may be important. The project area contains 966 acres of late-succession pine (SS 5) and 2,474 acres of aspen.

Broad-winged Hawk – Direct/Indirect Effects

Alternative 1 (No Action): Alternative 1 would have no direct impacts because no new activities would occur. Habitat for this species would be expected to remain stable over the next five to 10 years unless disturbed by fire or mountain pine beetle infestation. Forest succession would favor development of additional late-succession pine but may decrease the aspen component.

Alternatives 2, 3, and 4: These alternatives could result in individual mortality due to nest loss or abandonment if birds are disturbed by nearby management activities. Application of Forest Plan Standard 3204 would reduce this risk by protecting raptor nests.

None of these alternatives would affect existing late-succession pine (966 acres). Thinning of SS 4B and 4C stands would move stands toward some late-succession characteristics by retaining many of the largest, oldest trees and promoting diameter growth in these trees, though stand density would decrease. Other treatments in 4B and 4C stands such as shelterwood seedcut would substantially reduce density and suitability as nesting habitat. Alternatives 3 and 4 would be expected to enhance aspen habitat through removal of pine (1,000 acres).

The most acres of SS 4B/4C would remain under Alternative 1 and the fewest under Alternative 3.

Table 34: Preferred Habitat for Broad-winged Hawk Nesting in the Project Area

	Alternative			
	1	2	3	4
Late-successional pine	966	966	966	966
Structural stage 4B/4C	8,527	3,930	3,087	3,362
Aspen	2,474	2,474	2,474	2,474
Aspen enhancement treatments	0	0	1,000	1,000

Broad-winged Hawk Cumulative Effects

The cumulative effects analysis area for broad-winged hawk is NFS lands in the project area. This area is selected because this species is associated with a variety of habitat types. The time span for the cumulative effects analysis is from 1990 to 2017 to account for past activities that are still affecting pine habitat and completion of all activities included in the Moskee proposals.

The Coyote and Wish timber sales reduced pine stand density on 655 acres, though no SS 4C or 5 stands were treated (USFS 1998). Effects were similar to those described above under direct/indirect effects. These projects also removed pine from 66 acres of aspen, maintaining this habitat. The Adams and Bald-Carnegie prescribed burns took place primarily in stands that already had low to moderate density, so effects on broad-winged hawk habitat were minimal.

The potential Moskee land exchange does not include any late-succession or aspen forest. Riparian areas may be acquired, but these are primarily open meadows with few hardwoods, limiting their habitat value for broad-winged hawk.

Alternative 1 (No Action): Under Alternative 1, remaining timber harvesting in the Coyote and Wish sales (1,135 acres) will not occur in SS 4C or 5 stands. Forest succession and density would continue to increase in the absence of disturbance events.

Alternatives 2, 3, and 4: These alternatives would add to cumulative effects by decreasing density of pine stands that could develop into SS 5. Alternatives 3 and 4 would enhance potential habitat in aspen through 1,000 acres of pine removal. Alternatives 2, 3, and 4 would contribute toward achievement of Forest-wide Objective 221 by enhancing aspen and maintaining existing late-succession forest.

Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that the broad-winged hawk is likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if

conditions move towards management objectives. All action alternatives would comply with Forest Plan direction. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Northern Saw-whet Owl – Affected Environment

Saw-whet owls occur from the southern boundary of Alaska, across most of Canada and into the northern tier of states from Maine to Minnesota (Johnson and Anderson 2003). The Rocky Mountains, the Cascade Range, Coastal Range, and the Sierra Mountains all support year-round populations. In the Black Hills, seasonal migration between high and low elevation habitat is likely (Johnson and Anderson 2003). The saw-whet owl can be found in more dense coniferous forests and dense riparian woodlands. This owl nests in cavities of snags excavated by flickers or other large woodpeckers (Johnson and Anderson 2003). Nests tend to be in mature forests (SS 4C and 5), while dense sapling-pole sized stands are preferred for roosting (Johnson and Anderson 2003). This species preys on small mammals, particularly deer mice, and birds.

There are few documented observations of the saw-whet owl on the Forest, mainly because of the bird's nocturnal habits. Saw-whet owls have been encountered four times by RMBO program surveyors, and two of these observations were not associated with a transect. However, according to Panjabi (2005), this species may be fairly common throughout most of the Black Hills forest types. It has been documented in Crook County.

The Moskee project area currently contains 3,366 acres of dense, mature coniferous forest (SS 4C and 5) and 70 acres of dense sapling/pole size stands (SS 3C). Stand data indicate another 4,700 acres of mature, dense to moderately dense forest (SS 4B or 4C) with pine seedling/sapling understory. Snag density meets Objective 211 (see page 69).

Northern Saw-whet Owl – Direct/Indirect Effects

Alternative 1 (No Action): There would be no direct effects because no new activities would occur. Potential indirect effects include increase in nesting and foraging habitat over time as forest matures and becomes denser. Snag habitat would not be impacted. This alternative is likely to be the most beneficial for saw-whet owls. Risk of a stand-replacing wildfire would be highest under this alternative, and such an event would reduce habitat suitability for this species.

Alternatives 2, 3, and 4: None of these alternatives would affect existing late-succession (SS 5) stands. Proposed treatments would reduce acreage of other dense, mature pine stands (SS 4C) (see Table 35). Suitability of treated areas for saw-whet owls would decrease. Inadvertent loss of some individual birds or nests is possible under Alternatives 2, 3, and 4 if active nests are present in treated areas. Removal of mature trees in treatment units may decrease the availability of nesting trees. This effect may be most likely to occur under Alternative 3, which proposes commercial timber harvesting in the most SS 4C stands. Identified stands of roosting habitat (SS 3C) would remain nearly steady under all alternatives. Proposed regeneration harvesting would create conditions for development of future roosting habitat. Under all action alternatives, cutting of snags would generally be prohibited except to protect worker safety. For further discussion of effects on snags, see page 69.

Table 35: Effects on Northern Saw-whet Owl Habitat

	Alternative			
	1	2	3	4
Nesting habitat (structural stage 4C/5) (acres)	3,366	1,812	1,593	1,627
Roosting habitat (structural stage 3C) (acres)	70	70	62	62

Northern Saw-whet Owl – Cumulative Effects

The cumulative effects analysis area for saw-whet owl is ponderosa pine habitat in the project area (18,107 acres). This area is selected because saw-whet owls are associated with pine forest and effects on this species from activities outside the project area are not expected to overlap temporally or spatially with effects of this project. The time span for the cumulative effects analysis is from 1990 to 2017 to account for past activities that are still affecting pine habitat and completion of all activities included in the Moskee proposals.

The Coyote and Wish timber sales reduced pine stand density on 655 acres, though no SS 4C or 5 stands were treated (USFS 1998). These actions did not affect existing saw-whet owl habitat but reduced density or set back succession in moderately dense, mature stands that could have developed into SS 4C or 5. The Adams and Bald-Carnegie prescribed burns took place primarily in stands that already had low to moderate density, so effects on this habitat were minimal. Effects on these projects on snags are unknown, but existing snag density complies with Objective 211.

Ongoing and planned precommercial thinning (458 acres) and POL thinning (817 acres) will not affect the existing 70 acres of SS 4C. Remaining timber harvesting in Coyote and Wish (1,135 acres) will not occur in SS 4C or 5 stands. The potential Moskee land exchange would not trade SS 3C or late-succession forest. Future uneven-age management entries would be expected to result in additional sapling and pole stands of pine suitable for use as roosting habitat.

Alternative 1 (No Action): Alternative 1 would not add to cumulative effects of stand density reduction. Forest succession and stand density would continue to increase in the absence of disturbance events.

Alternatives 2, 3, and 4: Alternatives 2, 3, and 4 would add to cumulative effects by decreasing density of SS 4C stands, but would increase acreage of younger structural stages that could develop into roosting habitat. These alternatives would contribute toward achievement of Forest-wide Objective 221 by maintaining existing late-succession forest, generally conserving snags, and creating conditions for development of sapling stands.

Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS. The Phase 2 Amendment FEIS determined that the broad-winged hawk is likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives. All action alternatives would comply with Forest Plan direction. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Pygmy Nuthatch – Affected Environment

This species ranges from southern interior British Columbia, northern Idaho, western Montana, central Wyoming, and southwestern South Dakota south to Baja California, Mexico, and western Texas. Pygmy nuthatches are cavity nesters generally associated with open, mature ponderosa pine forests (Ghalambor 2003; Scott 1979) with less than 70 percent canopy cover (SS 4A, B, and open 5) (Clark et al. 1989). Because they rely on cavities for roosting and for breeding, pygmy nuthatches typically reach their highest population densities in mature pine forests little affected by disturbance and with a large number of standing dead trees (Kingery and Ghalambor 2001). Keller (1992) demonstrated a dependence on snags and relatively large trees. This species is sensitive to forest alteration, and has shown declines when timber activities have removed snags (Ghalambor 2003).

The pygmy nuthatch is a rare but regular, and apparently widespread, resident in the Black Hills. In 2005, RMBO observed four pygmy nuthatches in burned areas and southern Black Hills ponderosa habitats (Panjabi 2006). This species has been sighted more frequently in recent years, but is of uncertain status in the northern hills (SDOU 1991). Pygmy nuthatch has not been documented in the Moskee area, but was observed during the 1980 Breeding Bird Survey just to the north of the project area (BBS 1991).

The project area contains 13,988 acres of open, mature pine forest. Snag density meets Objective 211 (see page 69).

Pygmy Nuthatch – Direct/Indirect Effects

Alternative 1 (No Action): Alternative 1 would have no direct impacts because no new activities would occur. Potential indirect effects include increased density of currently open stands. Snag density is likely to be highest under this alternative.

Alternatives 2, 3, and 4: Under these alternatives, proposed treatments would decrease density of mature pine stands. Open, mature pine stands (structural stage 4A) would increase by about 43 percent under Alternative 2, 42 percent under Alternative 3, and 41 percent under Alternative 4. Inadvertent loss of some individual birds or nests is unlikely but possible if undetected nests are present in treated areas. Removal of mature trees within the treatment units may decrease the availability of nesting trees. Under all action alternatives, cutting of snags would generally be prohibited except to protect worker safety. For further discussion of effects on snags, see page 69.

Pygmy Nuthatch – Cumulative Effects

The cumulative effects analysis area for pygmy nuthatch is ponderosa pine habitat in the project area (18,107 acres). This area is selected because pygmy nuthatches are associated with coniferous forest. The time span for the cumulative effects analysis is from 1990 to 2017 to account for past activities that are still affecting habitat and completion of all activities included in the Moskee proposals.

The Coyote and Wish timber sales reduced density of pine stands on 655 acres, increasing potential pygmy nuthatch habitat. The Adams and Bald-Carnegie projects included 2,800 acres of prescribed burning, which enhanced potential habitat by reducing competition within pine stands. Effects on these projects on snags are unknown, but

existing snag density complies with Objective 211.

The Coyote and Wish sales will thin or regenerate pine on an additional 1,135 acres, adding to cumulative effects by reducing density of treated stands.

Alternative 1 (No Action): Alternative 1 would not add to cumulative effects. Forest succession and stand density would increase in the absence of disturbance events.

Alternatives 2, 3, and 4: These alternatives would add to cumulative effects by decreasing density of pine stands. These alternatives may also add to cumulative effects on snags as some may be cut for safety reasons. Alternatives 2, 3, and 4 would contribute toward achievement of Forest-wide Objective 221 by increasing potential habitat and generally conserving snags.

Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that pygmy nuthatch is likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives. All action alternatives would comply with Forest Plan direction. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Black-and-white Warbler – Affected Environment

The black-and-white warbler breeds in mature deciduous forests of the eastern United States and throughout Canada. This species has been observed on 26 occasions since the MBBH program began in 2001. Two additional records exist in the NRIS fauna wildlife database. Most were in riparian zones and/or drainages. The vegetation composition of these habitats has not been analyzed, but it is suspected that bur oak, green ash, aspen, and other hardwoods are important, as is a dense understory of shrubs such as ninebark, chokecherry, hawthorn, and currants (USFS 2007a). This species has not been documented in the project area. There are 2,474 acres of aspen cover type in the project area, 24 acres of birch, and 24 acres of oak. These and other hardwood species are also present in the understory of many pine stands. Drainages in the project area are generally dry and there are few riparian areas.

Black-and-white Warbler – Direct/Indirect Effects

Alternative 1 (No Action): There would be no direct effects because no new activities would occur. In the absence of disturbance events, forest succession that favors pine and contributes to loss of aspen and other hardwoods would be expected to occur. Habitat fragmentation may increase. Risk of stand-replacing wildfire and mountain pine beetle infestation would be highest under this alternative. Wildfire would be expected to have short-term (three- to five-year) negative effects, but long-term (five- to 50-year) beneficial effects by expanding and stimulating aspen stands.

Alternatives 2, 3, and 4: These alternatives would benefit warbler habitat by removing pine from aspen stands and prescribed burning (Table 36). These activities may also have short-term (less than five-year) negative effects such as individual mortality, habitat loss, or disturbance. Alternative 3 would enhance conditions for aspen on the largest area and may have the greatest beneficial effect on black-and-white warbler habitat.

Table 36: Activities that Could Affect Habitat for Black-and-white Warbler

Activities	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Enhancement of aspen habitat	0	0	1,000	1,000
Prescribed burning	0	3,911	6,348	1,661

Black-and-white Warbler – Cumulative Effects

The cumulative effects analysis area for black-and-white warbler is NFS lands in the project area (22,570 acres). This area is selected because, while this species is primarily associated with hardwoods and riparian areas, many pine stands in the project area have an understory aspen component that may provide suitable or transitory habitat. The time span for the cumulative effects analysis is from 1990 to 2017 to account for past activities that are still affecting this habitat and completion of all activities included in the Moskee proposals.

The Coyote and Wish timber sales removed pine from 48 acres of aspen and regenerated 18 acres of aspen. Pine will be removed from an additional 37 acres of aspen under the Coyote sale. These actions, as well as 2,800 acres of prescribed burning (Bald-Carnegie and Adams), positively affected potential warbler habitat by enhancing hardwood stand condition. The proposed Moskee land exchange would result in acquisition of open meadows with historic beaver dams and the potential to be managed for improvement of riparian habitat.

Alternative 1 (No Action): Alternative 1 would not add to cumulative effects. Forest succession to pine would continue in the absence of disturbance events.

Alternatives 2, 3, and 4: Alternatives 3 and 4 would add to cumulative effects by reducing pine competition with aspen. Alternatives 2, 3, and 4 would enhance conditions for understory hardwoods through pine stand density reduction and prescribed burning. These alternatives would contribute toward achievement of Forest-wide Objective 221 by enhancing hardwood conditions.

Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that black-and-white warbler is likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives. All action alternatives would comply with Forest Plan direction. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Northern, Small-footed, Long-eared, and Long-legged Myotis – Affected Environment

Similarities in habitat preferences and effects allow these species to be addressed together.

The northern myotis ranges across most of eastern North America. It has been documented across the Black Hills region (Higgins et al. 2000; Cerovski et al. 2004). The northern myotis is found in wooded riparian zones in badlands and prairies to higher elevation coniferous and deciduous woodlands (Schmidt 2003). Hibernacula for this species include mines and caves. Day roosts have been reported in buildings, under

shingles, underneath bark, inside tree cavities, and in caves, mines, and quarries. Northern myotis bats have been documented using ponderosa pine snags as summer/maternity roosts in the Black Hills (Tigner and Stukel 2003). Moths and beetles make up most of this bat's diet (Schmidt 2003). This species has not been documented in the project area.

The small-footed myotis ranges across much of western North America, from central Canada south to the central states of Mexico (Schmidt 2003a). The species is widespread, but not abundant throughout the Black Hills region. It is found in a wide range of habitat types and is usually associated with rocky outcroppings within this broad range of habitat types (Schmidt 2003a). 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. Small-footed myotis has not been documented in the project area.

The long-eared myotis ranges across much of montane western North America, from west central Canada south to Baja California along the Pacific coast, along the western edges of the Dakotas, and most of Wyoming and Colorado to northwestern New Mexico and northeastern Arizona (Schmidt 2003b). This species is associated with coniferous montane habitats and has been reported foraging among trees and over woodland ponds. Hibernacula for this species include mines and caves, although they have not been documented hibernating in the Black Hills (Schmidt 2003b). Day and maternity roosts in the Hills are found in buildings, rock crevices, snags, under loose bark, and caves and mines. Limited data suggest they use ponderosa pine snags as day and maternity roosts in other regions. Moths and beetles are believed to be important prey items (Schmidt 2003b). This species has not been documented in the Moskee project area.

The long-legged myotis is common across the western United States. Its range extends across much of western North America from southeastern Alaska into central Mexico (Schmidt 2003c). This species is considered the most common and widely distributed member of the genus *Myotis* and has been documented across the Black Hills region (Schmidt 2003c). It is primarily associated with montane forest, and forages over meadows, ponds, streams, and open mesic habitats in the Black Hills. Hibernacula include mines and caves. Day and maternity roosts have been documented rock crevices, buildings, under the bark of trees and in snags (Schmidt 2003c). Ponderosa pine snags are used as summer/maternity roosts in the Black Hills. Moths appear to comprise the majority of this species' diet, and it is known to feed on the spruce budworm moth (Schmidt 2003c). This species has not been documented in the project area.

Current snag densities meet Objective 211. The National Forest is largely conserving habitat for these species (USFS 2007a).

Northern, Small-footed, Long-eared, and Long-legged Myotis – Direct/Indirect Effects

Alternative 1 (No Action): There would be no direct impacts because no new activities would occur. Potential indirect impacts include loss of foraging habitat due to increasing pine stand density and encroachment of pine into meadow and riparian areas. Risk of potential negative impacts from wildfire, both direct (mortality) and indirect (roost habitat loss), would be greatest under this alternative. Risk of mountain pine beetle

infestation would continue to increase; infestation may benefit these species by increasing roost habitat, foraging habitat, and insect prey availability. This alternative would be expected to maintain habitat in accordance with Objective 221 except possibly in the case of a stand-replacing fire.

Alternatives 2, 3, and 4: There are no caves or mines in the project area, so there would be no effects on potential hibernacula. Proposed harvest of mature trees could result in direct impacts (mortality) and indirect impacts (loss of day or maternity roost habitat). Except on the sites proposed for overstory removal or group selection, harvested areas would remain forested with mature trees that would continue to provide potential roosting habitat. Because Alternative 3 would conduct timber harvest and burning on the largest area, it would be expected to have the greatest potential for direct and indirect effects on bats and their habitat. Alternatives 2 and 4 would be expected to have similar potential for effects on bats, less than Alternative 3. Removal of snags for safety reasons may have similar direct and indirect effects. Existing snag densities in the project area exceed Objective 211 requirements; incidental loss of snags would not be expected to substantially reduce densities or limit roosting habitat.

Under Alternatives 2, 3, and 4, lack of effects on caves or mines, creation of open pine habitat, and retention of most snags would be expected to maintain or enhance habitat in accordance with Objective 221.

Northern, Small-footed, Long-eared, and Long-legged Myotis – Cumulative Effects

The cumulative effects analysis area for these bat species is NFS lands in the project area (22,570 acres). This area is selected because potential bat habitat is scattered across the project area. The time span for the cumulative effects analysis is from 1990 to 2017 to account for past activities that are still affecting this habitat and completion of all activities included in the Moskee proposals.

The Coyote and Wish timber sales removed pine from 48 acres of aspen and regenerated 18 acres of aspen. Pine will be removed from an additional 37 acres of aspen under the Coyote sale. These actions, as well as 2,800 acres of prescribed burning (Bald-Carnegie and Adams), positively affected potential bat habitat by enhancing hardwood stand condition. Effects of the Coyote and Wish timber sales on snags are unknown, but existing snag densities comply with Objective 211.

Alternative 1 (No Action): Alternative 1 would not add to these cumulative effects. Forest succession and pine cover would increase in the absence of disturbance events. Snag density would be expected to be highest under this alternative.

Alternatives 2, 3, and 4: These alternatives would add to cumulative effects by decreasing pine encroachment. These alternatives would also be expected to add to cumulative effects on snags as some may be cut for safety reasons. Alternatives 2, 3, and 4 would contribute toward achievement of Forest-wide Objective 221 by maintaining potential foraging habitat and generally conserving snags.

Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that these bat species are likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives. All action alternatives would comply with Forest

Plan direction. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Northern Flying Squirrel – Affected Environment

The northern flying squirrel occupies forested areas in much of Canada and parts of the western United States, with a separate population in the Black Hills of South Dakota and Wyoming (Higgins et al. 2000). They inhabit mature, dense woodland habitats dominated by conifers or mixed conifer and deciduous forest. Anecdotal evidence suggests that, in the Black Hills, flying squirrels are habitat generalists and can be found in open pine habitat adjacent to more densely vegetated hardwood habitats. They are likely benefit from any hardwood enhancement, as they have been documented in aspen stands and riparian hardwood stands. This squirrel nests in a leaf nest or tree cavity and is considered uncommon in Wyoming (Cerovski et al. 2004). It feeds on lichens, fungi, conifer cones, fruit, buds, arthropods, bird eggs, and nestling birds (Cerovski et al. 2004). It has not been documented in the project area.

The project area contains 2,474 acres of aspen, 3,366 acres of dense, mature pine forest (SS 4C/5), and 6,160 acres of SS 4B, which may include a hardwood understory. Existing snag density meets Objective 211.

Northern Flying Squirrel – Direct/Indirect Effects

Alternative 1 (No Action): There would be no direct effects because no new activities would occur. Potential indirect effects include increase in denning habitat over time as additional snags develop. This alternative may be the most beneficial for flying squirrels. Risk of a stand-replacing wildfire would be highest under this alternative, and such an event would reduce habitat suitability for this species.

Alternatives 2, 3, and 4: Under these alternatives, proposed treatments would reduce acreage of dense, mature pine stands (see Table 37). Suitability of treated areas for flying squirrels may decrease, although possible increases in hardwoods would be expected to benefit this species. Inadvertent loss of individuals is possible under Alternatives 2, 3, and 4 if trees with occupied dens are cut. Under all action alternatives, cutting of snags would generally be prohibited except to protect worker safety. For further discussion of effects on snags, see page 69.

Table 37: Effects on Preferred Northern Flying Squirrel Habitat

Activity or Effect	Alternative			
	1	2	3	4
Hardwood enhancement proposed	0	0	1,000	1,000
Dense, mature forest (SS 4C/5)	3,366	1,812	1,593	1,627
Moderately dense, mature forest (SS 4B)	6,160	3,084	2,460	2,701

Northern Flying Squirrel – Cumulative Effects

The cumulative effects analysis area for flying squirrels is the NFS lands in the project area. This area is selected because flying squirrels are associated with various habitat conditions. The time span for the cumulative effects analysis is from 1990 to 2017 to account for past activities that are still affecting pine habitat and completion of all activities included in the Moskee proposals.

The Coyote and Wish timber sales reduced pine stand density on 655 acres, though no SS 4C or 5 stands were treated (USFS 1998). Remaining timber harvesting in the Coyote and Wish sales (1,135 acres) will not occur in SS 4C or 5 stands. Though these actions did not affect dense, mature pine stands, they reduced density or set back succession in moderately dense, mature stands that could have developed into SS 4C or 5. The Adams and Bald-Carnegie prescribed burns took place primarily in stands that already had low to moderate density, so effects on preferred habitat may have been minimal. Effects of the Coyote and Wish timber sales on snags are unknown, but existing snag densities comply with Objective 211.

The Moskee land exchange does not propose trading of any SS 5 forest.

Alternative 1 (No Action): Alternative 1 would not add to these cumulative effects. Forest succession and stand density would continue to increase in the absence of disturbance events. Snag density would be expected to be highest under this alternative.

Alternatives 2, 3, and 4: Alternatives 2, 3, and 4 would add to cumulative effects by decreasing pine encroachment of aspen. These alternatives would also be expected to add to cumulative effects on snags, as some may be cut for safety reasons. Alternatives 2, 3, and 4 would contribute toward achievement of Forest-wide Objective 221 by maintaining potential denning and foraging habitat and generally conserving snags.

Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that northern flying squirrel is likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives. All action alternatives would comply with Forest Plan direction. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist's report.

Meadow Jumping Mouse – Affected Environment

Meadow jumping mice occur across portions of Alaska east through much of Canada and in the eastern United States as far south as Georgia and Alabama (Higgins et al. 2000). In the United States, its range extends west 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 is associated with marshy areas and moist grasslands near streams, coniferous and deciduous forests, mixed shrublands and riparian shrublands (Cerovski et al. 2004). It feeds on buds, grasses, seeds, fungi, leaves, fruit, and insects.

Meadow jumping mice tend to occur at relatively low abundance and it is uncertain whether current abundance is different from that of the past. A recent survey (Cryan and Ellison 2005) found meadow jumping mice at all historic localities in the Bear Lodge Mountains and Black Hills. Meadow jumping mice were captured more frequently than all other species of mice in the Bear Lodge Mountains. In the Black Hills of South Dakota, meadow jumping mice and red-backed voles were the most frequently captured rodent species. Limits on abundance and distribution include reduction of understory shrubs, grasses, and forbs in low-to-mid elevation riparian areas (Cerovski et al. 2004, WYNDD 2002). Fragmentation of appropriate riparian habitat may limit this species'

ability to disperse. There are no known occurrences in the Moskee project area, but suitable habitat exists, particularly in scattered riparian areas and near springs and seeps.

Meadow Jumping Mouse – Direct/Indirect Effects

Alternative 1 (No Action): Alternative 1 would have no direct impacts because no new activities would occur. Continued encroachment of riparian meadows and aspen stands by pine may decrease habitat. Risk of mountain pine beetle infestation and fire would remain elevated. These events would be expected to diversify jumping mouse foraging habitat by increasing development of understory hardwoods, shrubs, forbs, and grasses.

Alternatives 2, 3, and 4: Alternatives 2, 3, and 4 have the potential to cause mortality of individual mice. Alternatives 3 and 4 may have beneficial impacts by enhancing riparian meadow and hardwood habitat through removal of pine (2,178 acres). Prescribed burning and timber harvesting may have negative impacts on habitat for one or two years by reducing hiding cover, but would increase understory cover within two to three years. Proposed road closure and decommissioning may reduce disturbance of habitat.

Meadow Jumping Mouse – Cumulative Effects

The cumulative effects analysis area for meadow jumping mouse is all ownerships in the project area. This area is selected because jumping mice are associated with riparian habitat, and much of this habitat in the project area is found on non-NFS lands that may be included in a future land exchange. The time span for the cumulative effects analysis is from 1990 to 2017 to account for past activities that are still affecting this habitat and completion of all activities included in the Moskee proposals.

The Coyote and Wish timber sales and Bald-Carnegie and Adams prescribed burns have had little effect on riparian shrub habitat. These projects took place or are taking place mostly in uplands and primarily in ponderosa pine stands. Ongoing activities such as water diversion and livestock grazing affect riparian areas more directly. These activities have contributed to reduction in surface water and health of riparian shrub communities. Many non-NFS parcels in the project area are also grazed and have few shrubs in riparian areas. Most of the parcels currently being considered for acquisition in the Moskee land exchange include riparian meadows with few shrubs. If the Forest Service acquires these parcels, application of Forest Plan Standards and WCPH direction to these riparian areas could result in improved habitat for jumping mice.

Alternatives 1, 2, 3, and 4: Alternative 1 would not add to cumulative effects described above. Because Alternatives 2, 3, and 4 may improve aspen and riparian meadow habitat, they would not be expected to add to cumulative effects. All alternatives would contribute to achievement of Objective 221.

Population viability was analyzed at the Forest scale in the Phase 2 Forest Plan Amendment FEIS, which determined that meadow jumping mouse is likely to persist on the Forest over the next 50 years if Standards and Guidelines are followed, and if conditions move towards management objectives. All action alternatives would comply with Forest Plan direction. Further discussion of consistency with Forest Plan direction is included in the wildlife specialist’s report.

Migratory Birds

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, and approaches bird conservation at several levels by implementing 1) Forest Plan objectives, standards and guidelines, 2) a Forest-wide bird monitoring program, and 3) site-specific mitigation and effects analyses for identified species of concern.

The highest priority (Level 1) bird species listed in the Wyoming Partners in Flight (PIF) Bird Conservation Plan for forest, montane riparian, and aspen habitat groups include northern goshawk and bald eagle. Goshawk is discussed in Appendix 4 (Wildlife Biological Assessment/Biological Evaluation). The US Fish and Wildlife Service's Birds of Conservation Concern (BCC) publication (USFWS 2002) partitions North America into 37 bird conservation regions (BCRs). The Black Hills is included in BCR 17 (Badlands and Prairies). Of the 24 bird species found in BCR 17, eleven are duplicated on the Regional Forester's sensitive species list and are evaluated in Appendix 4 if they have potential to occur in the Black Hills. Ten species are not expected to occur in the project area due to lack of habitat. A summary of these species can be found in Section E010 in the analysis file. The three remaining species (golden eagle, black-billed cuckoo, and red-naped sapsucker) or their habitats have potential to occur in the Moskee project area and are evaluated below.

Golden Eagle *(Aquila chrysaetos)* – Golden eagles occur throughout North America. The species is fairly common in the plains of the western US, Alaska and western Canada. They are year-round residents of Wyoming and western South Dakota, inhabiting open country primarily in hilly or mountainous regions but also in deserts and grasslands. They prefer to nest on cliff ledges, but will occasionally use trees for nesting (DeGraff et al. 1991).

The project area includes no large cliffs or rock faces that would provide typical nesting substrates. Contiguously forested habitats, such as those found within most of the proposed treatment areas, are not preferred by golden eagles, but they may be included in a home range if suitable nesting or foraging habitat is intermixed. Golden eagles have been recorded a number of times on Bearlodge District (district files) and by RMBO (Panjabi 2003). This species has been documented in the Moskee project area but is not known to nest there.

Proposed group selections (Alternatives 3 and 4) could temporarily increase potential foraging habitat by reducing forest cover. Proposed prescribed fire could also have a small positive effect by enhancing prey habitat. No other vegetation treatments or access proposals would be expected to have any effect on the eagle or its habitat. Any golden eagle nests found during project implementation would be protected under Standard 3204.

Red-naped Sapsucker *(Sphyrapicus nuchalis)* – 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.

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). It occurs in greatest density in aspen stands (D=13.8 birds/km^2 in Panjabi 2001, and D=10.4 birds/km^2 in Panjabi 2003). It has been observed in stands of aspen and birch and mixed pine-aspen stands in the project area and across the Bearlodge District.

Cutting of mature aspen or birch is not proposed under any alternative. Incidental cutting may occur in conjunction with road and fire control line construction. Treatments that remove pine could have a negligible negative effect on potential nesting habitat since sapsuckers may excavate cavities in pine but are more likely to use aspen. No other vegetation treatments or travel management proposals would be expected to affect red-naped sapsucker or its habitat.

Black-billed Cuckoo *(Coccyzus erythropthalmus)* – The black-billed cuckoo breeds from Alberta and Montana east to the maritime provinces and south to northern Texas, Arkansas, and South Carolina. It winters in South America. This species favors a variety of wooded or brushy habitat, avoiding extremely dense woods (DeGraff et al. 1991). It forages among leaves for caterpillars, insects, spiders, and fruit. Nests are usually in groves of trees, forest edges, moist thickets, or overgrown pastures (Peterjohn et al. 1995).

This species has been considered an uncommon migrant and summer resident in the Black Hills (Tallman et al. 2002). In 2001, Rocky Mountain Bird Observatory technicians observed a black-billed cuckoo near Galena in the northeastern Black Hills and another near Hop Creek in the north-central Hills (Panjabi 2003). Black-billed cuckoos have not been documented on the Bearlodge District, although suitable habitat exists.

The Moskee project area may provide suitable habitat in drainages forested with hardwoods, meadow edges, and open pine stands. Non-commercial removal of pine from meadow edges and hardwood stands, thinning, and prescribed fire could have a small positive effect on black-billed cuckoo habitat by increasing understory production and diversity.

Threatened, Endangered, Proposed, or Sensitive Species

Table 38 includes the federally listed and Region 2 sensitive species likely to occur on the Black Hills. Species without habitat in the project area were not analyzed further. Risk assessments were completed for sensitive species known to occur or with suitable habitat in the project area. Information on occurrence or potential occurrence was provided by sources listed on page 78. Table 39 displays the determinations for federally listed and Region 2 sensitive species for the Moskee project. For a complete analysis of effects on these species, refer to Appendix 4 (Wildlife Biological Assessment/Biological Evaluation).

Table 38: Federally Listed and Region 2 Sensitive Wildlife in the Black Hills

Species	Status[a]	Known to Occur in Project Area?	Habitat Present in Project Area?	Habitat Description
Bald Eagle (*Haliaeetus leucocephalus*)	S	No	Yes	Winter resident in the Black Hills and spring/fall migrant. Usually found near unfrozen water or carrion in winter (Tallman et al. 2002).
Fringed myotis (*Myotis thysanodes)*	S	No	Yes	Forages on insects in a variety of habitats including grasslands and forested areas. Roosts in a variety of structures including caves, mines, and buildings (Schmidt 2003d).
Townsend's big-eared bat *(Corynorhinus townsendii)*	S	No	Yes	Forages on insects in a variety of habitats including forested and wet areas. Roosts in a variety of structures including caves, mines, and buildings (Schmidt 2003e).
Black-tailed prairie dog *(Cynomys ludovicianus)*	S	No	No	Short-grass and mixed-grass prairies (Higgins et al. 2000).
American marten *(Martes americana)*	S	No	No	Spruce forests with complex near-ground structure, extending into Adjacent ponderosa pine stands (Buskirk 2002).
Northern goshawk *(Accipiter gentilis)*	S	Yes	Yes	Forages in a variety of forested areas and small openings; nests primarily in dense mature conifer forests (Erickson 1987).
American peregrine falcon *(Falco peregrinus anatum)*	S	No	No	Tall cliffs in open areas near water (Tallman et al. 2002).
Northern harrier *(Circus cyaneus)*	S	No	No	Prairies, open fields and marshes (Tallman et al. 2002).
Yellow-billed cuckoo *(Coccyzus americanus)*	S	No	Yes	Low elevation riparian areas and woodlands characterized with cottonwood-willow or bur oak (Panjabi 2003).
Burrowing owl *(Athene cunicularia)*	S	No	No	Dry grasslands and pastures, usually associated with prairie dogs or ground squirrels (Tallman et al. 2002).
Flammulated owl *(Otus flammeolus)*	S	No	Yes	Open ponderosa pine forests (McCallum 1994).
Lewis' woodpecker *(Melanerpes lewis)*	S	No	Yes	Open burned areas with large snags; oak and cottonwood forests (Anderson 2003, Panjabi 2003).
Black-backed woodpecker *(Picoides arcticus)*	S	Yes	Yes	Burned areas with a high density of pre-burn snags; dense and/or mature forests with a high snag density (Anderson 2003, Panjabi 2003).
American three-toed woodpecker *(Picoides dorsalis)*	S	No	No	Mature spruce forests, burned areas (Panjabi 2003).
Loggerhead shrike *(Lanius*	S	No	No	Open country with scattered, low deciduous thickets (Tallman et al. 2002).

Species	Status[a]	Known to Occur in Project Area?	Habitat Present in Project Area?	Habitat Description
ludovicianus)				
Grasshopper sparrow *(Ammodramus savannarum)*	S	No	No	Found almost exclusively in native mixed-grass prairies (Panjabi 2003).
Northern leopard frog *(Rana pipiens)*	S	Yes	Yes	Riparian and wetland areas for tadpoles, subadults, and breeding adults; upland habitats for foraging adults (Smith 2003).
Black Hills redbelly snake *(Storeria occipitomaculata pahasapae)*	S	Yes	Yes	Wet meadows, woodlands, and forest-meadow edge habitat in the Black Hills (Smith and Stephens 2003).
Lake chub *(Couesius plumbeus)*	S	No	No	Streams or lakes with clear, cool water and clean cobble/gravel substrate; only population on the Forest is in Deerfield Reservoir (Isaak et al. 2003).
Finescale dace *(Phoxinus neogaeus)*	S	No	No	Small lakes and cool, boggy environments associated with springs or beaver dams (Isaak et al. 2003).
Mountain sucker *(Catostomus platyrhynchus)*	S	No	No	Large rivers, lakes, reservoirs, prairie streams but most often in cool, clear, moderately swift mountain streams with mud, cobble, or boulder substrate (Isaak et al. 2003).
Cooper's Rocky mountainsnail *(Oreohelix strigosa cooperi)*	S	Yes	Yes	Lowland wooded or riparian areas on limestone soils (Frest and Johannes 2002).
Regal Fritillary *(Speyeria idalia)*	S	No	No	Tallgrass prairie and extensive grasslands with violets (Marrone 2002).
S = Sensitive				

Table 39: Determination Summary for Fully Analyzed Sensitive Wildlife Species

Species	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Bald eagle	No Impact	No Impact	No Impact	No Impact
Fringed myotis	MAII[a]	MAII	MAII	MAII
Townsend's big-eared bat	MAII	MAII	MAII	MAII
Northern goshawk	MAII	MAII	MAII	MAII
W. Yellow-billed cuckoo	MAII	MAII	MAII	MAII
Flammulated owl	MAII	MAII	MAII	MAII
Lewis' woodpecker	MAII	MAII	MAII	MAII
Black-backed woodpecker	No Impact	MAII	MAII	MAII
Northern leopard frog	MAII	MAII	MAII	MAII
Black Hills redbelly snake	MAII	MAII	MAII	MAII
Cooper's Rocky Mountainsnail	MAII	MAII	MAII	MAII

[a] May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing.

Fire and Fuels

This section presents an analysis of fire hazard and fuels management in the project area. The general analysis of the landscape is considered as well as site-specific forest fuels conditions.

Fire and Fuels – Affected Environment

Ponderosa pine is the dominant tree species in the project area, occurring at all elevations, on all soil types, and on all aspects. Aspen is also a significant tree species in the project area, particularly in the Moskee Fire area, which dominates most of the western portion of the project area. Small patches of birch occur on moister, cooler sites (Table 40; Map 5).

Table 40: Vegetation Cover Types in the Project Area

Cover Type	Acres	Percent of NFS acres
Grass/meadow	1,815	8.0%
Ponderosa Pine	18,107	80.7%
Aspen	2,473	11.1%
Paper Birch	24	<1%
Bur Oak	24	<1%
No Cover (gravel pit)	2	<1%

The topography of the analysis area is mostly rolling slopes, generally not exceeding 35 percent, and mostly has runs less than 1,000 feet from top to bottom. Ridge-to-valley vertical distance is usually less than 400 feet. The elevation ranges from about 5,200 to 6,500 feet.

Recent Fuel Reduction Activities

Recent fuel reduction activities within the project area include the Adams prescribed burn, conducted on about 700 acres between 2001 and 2003 (see Map 2 in Appendix 1). In 2005, 332 of these acres were reburned. The Bald-Carnegie Fuel Treatment project included 1,260 acres of mechanical treatments and about 2,100 acres of prescribed burning. The areas that have been burned once are probably approaching Condition Class 1. Because a fire return interval within the historical range has occurred, Condition Class 1 could be considered attained on the reburned 332 acres of the Adams prescribed burn.

High values in the project area include the Wagon Canyon Ranch Estate. This private property could be affected by a large wildfire burning in the project area, but the potential for serious damage or structure loss has been substantially reduced by the Bald-Carnegie Fuel Treatments project.

A series of strategically located fuel breaks was constructed in 1990 in the area south of Lost Canyon and north of the Weston County border. These treatments created a network of fuelbreaks averaging two chains (132 feet) wide with total length of nearly 300 chains (3.75 miles). The fuelbreaks followed ridgetops and broke about 1,500 acres into 40-acre sections. This was done by thinning of non-commercial understory with machine piling and burning.

Fire History

The project area has experienced large wildfires. The largest recorded fire in the area was Moskee Fire of 1936, which burned approximately 7,174 acres (see Map 2 in Appendix 1). Aspen and grassy ridges are still more prevalent than ponderosa pine in the burned area despite pine reestablishment efforts that took place from the late 1940s through the early 1970s. This program included use of dozers to clearing large patches of the burned ponderosa pine snags and encroaching aspen. Terraces were cut into these patches, and pine seedlings planted in rows. As in many other cases in the Black Hills, the planted pine has not grown well.

Other fires over one acre in size were as follows:

- Stanton Draw, August 1963 (80 acres)
- Stanton, June 2002 (22 acres)
- Grand, July 2002 (9 acres)
- Windmill, August 1988 (8 acres)

The Cement Fire in July of 2005, which was nearly 3,000 acres in size, burned about 50 acres in the northern part of the project area. (The Moskee project area does not overlap the previous Cement project area.)

Fire records for the Moskee project area were obtained from the Black Hills National Forest database, which covers 1970 through 2006. There were 74 fires in the project area during this time, or 2.1 fires per year. Seventy-five to 80 percent of the fires were 0.1 acres in size. The average size of fires in the project area since 2000 has grown, probably due to sustained drought.

Hunting is a popular use of the area, primarily in the fall, and for a month in the spring. This brings a seasonal increase in risk of human-caused wildfire. Hunters and logging

equipment are on record as the main cause for non-lightning ignited fires. Lightning, however, causes by far the most wildfires in the project area.

Existing Fuel Conditions

Fire Regime: See Map 6 in Appendix 1 for existing fire hazard rating.

Historically, fire regime played an important role in creating the mosaic of vegetation in the project area and across the Black Hills. Fire regime has been altered by fire suppression, livestock grazing, and other factors. Several fire history studies in the Black Hills have shown a pre-settlement fire return interval of 20 to 30 years in ponderosa pine forests. Since settlement, this interval has increased substantially and many stands have not burned in over 100 years (Sheppard and Battaglia 2002). Longer intervals between fires has permitted fuel buildup and formation of larger patches of closely spaced trees and, consequently, increased severity of fire behavior across larger areas than in ponderosa pine forests that burned more often (Brown and Seig 1996).

Brown and Sieg's research in the Black Hills of dendrochronological (tree growth ring) evidence of fire activity and growth patterns included three sample sites that fall within the Moskee project area (Riflepit Canyon). The study indicates that, prior to fire suppression, fire returned every 14 to 84 years with an average mean fire interval (MFI) of 34 years. This research also indicates that frequent, low-intensity fires were normal, but that climate cycles did alter the fire regime periodically. Evidence indicates that if a somewhat wetter period (perhaps a few years of much wetter-than-average precipitation) caused the interval to increase, fuels would accumulate and stand density would increase until the next dry cycle. Then a larger, more intense, stand-replacing fire burned though the area, which would be outside the norm of regular, low-intensity surface fire (Brown 1996). The natural (historical) fire regime for the Black Hills is Class I, as interpreted by Schmidt et al. (2002); the frequency (MFI) is 0 to 35 years and severity is surface and mixed.

Like ponderosa pine-dominated forests in the Black Hills and the Southwest, the fire regime in the Moskee project area has been substantially altered because of fire suppression and other actions and their effects on fuel structure. Prior to fire suppression efforts, the frequent, low-severity surface fires kept dry ponderosa pine stands sparse and open by killing young, newly established trees. With fire suppression, timber management, and livestock grazing (which reduces the amount of grass fuel, USFS 1996, pages III-206, 218), fire intervals have lengthened, and dense stands have developed in which fine grass fuels are less abundant and dense ladder fuels are capable of carrying fire up into the canopy. Consequently, high-severity fires can occur in dry ponderosa pine forests where historically they were rare because of the sparse ladder fuels and the lack of contiguous tree crowns (Schoennagel et al. 2004).

Brown and Cook (2006) describe the development of the modern-day landscape resulting from historic changes in ponderosa pine forests in the Black Hills:

> Ponderosa pine forests in the Black Hills historically consisted of a diverse landscape mosaic that varied from non-forested patches and open stands of very few trees to quite dense stands with many trees. Although much of the forest was relatively open, dense patches also were present and contributed to considerable spatial heterogeneity. Historic photographs and written accounts from the late

nineteenth century also document a highly diverse landscape containing abundant openings, open stands of larger ponderosa pine trees, and closed canopy stands of younger and smaller trees (Graves, 1899; Progulske, 1974; Grafe and Horsted, 2002). The existing forest contains about the same basal area on average as the historic forest, but existing basal area is comprised of smaller trees. This suggests that there has been a simplification in structure, with increased tree density leading to fewer gaps and more even spacing and size distributions within groups. Repeat photographs of originals taken in 1874 show relatively homogeneous and for the most part continuous canopies in many areas that were formerly more structurally diverse (Progulske, 1974; Grafe and Horsted, 2002). Relative increases in tree density have contributed to greater vertical and horizontal fuel continuity, and thus increases the likelihood for incidence and larger extent of crown fire (Fulé et al, 2002). More pole-sized trees within stands also increase the likelihood of bark beetle outbreaks, especially a concern in the Black Hills where mountain pine beetles have been a major disturbance agent during the twentieth century (Shepperd and Battaglia, 2002).

Condition Class: The Amended Forest Plan (Glossary pages 10 and 11) defines "Condition Class" as the depiction of the degree of departure from historical fire regimes, possibly resulting in alterations of key ecosystem components. These classes categorize and describe vegetation composition and structure conditions that currently exist inside the Fire Regime Groups. Based on coarse-scale national data, they serve as generalized wildfire risk rankings. The risk of loss of key ecosystem components from wildfires increases from Condition Class 1 (lowest risk) to Condition Class 3 (highest risk). Based on coarse-scale national data, fire Condition Class measures general wildfire risk as follows:

<u>Condition Class 1:</u> For the most part, fire regimes in this class are within historical ranges. Vegetation composition and structure are intact. Thus, the risk of losing key ecosystem components from the occurrence of fire remains relatively low.

<u>Condition Class 2:</u> This term means the condition class description developed by the USDA Forest Service Rocky Mountain Research Station (RMRS) in the Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management (RMRS-GTR-87, http://www.fs.fed.us/rm/pubs/rmrs_gtr87.html), dated April 2000, under which:

- Fire regimes on the land have been moderately altered from historical ranges;
- A moderate risk exists of losing key ecosystem components from fire;
- Fire frequencies have increased or decreased from historical frequencies by one or more return intervals, resulting in moderate changes to (1) the size, frequency, intensity, or severity of fires; (2) or landscape patterns; and (3) vegetation attributes have been moderately altered from their historical ranges.

<u>Condition Class 3:</u> This term means the condition class description developed in RMRS-GTR-87 (see above), under which:

- Fire regimes on the land have been moderately altered from historical ranges;
- A moderate risk exists of losing key ecosystem components from fire;
- Fire frequencies have increased or decreased from historical frequencies by one or more return intervals, resulting in moderate changes to (1) the size, frequency, intensity, or severity of fires; (2) or landscape patterns; and (3) vegetation

attributes have been moderately altered from their historical ranges.

Most of the project area is best described by Condition Class 3 with a smaller area of Condition Class 2, based on the departure from historical frequencies of fire return and the current vegetation structure. Primarily due to suppression, most of the project area has not experienced a fire for 100 years or more. Therefore, most of the project area has missed two to three historical fire return intervals. Surface vegetation such as common juniper (*Juniperus communis*), which has been shown to be easily killed by low-intensity surface fire, grows in many sites within the project area. Many of these junipers are at least 60 years old. Grasses and palatable forbs are sparse until fire kills the decadent surface vegetation and restores the habitat to historical conditions.

Mountain Pine Beetle Infestation and Fuels

Pine stands where beetles cause high levels of mortality experience large changes in fine fuel levels two to three years after infestation. After the needles fall from the dead trees, the sheltering effect of a canopy is gone. It was observed after the northern Black Hills beetle epidemics of the late 1970s and early 1980s that infested stands experienced increased levels of fine fuels due to needle-cast combined with an increase in the grass component. While this provided more short-term forage for wildlife and livestock, the grasses tended to be taller species of rye and brome, which are not preferred forage. The result was a three- to five-year period where the needle-cast combined with a thick mat of dead grasses made up the fine fuel component. A wind-driven fire in that situation would likely have high rates of spread.

Typically, about seven to eight years after infestation, the snags begin to break off and topple over. This creates accumulations of downed heavy fuels. The fine fuels are then mostly limited to dry grass thatch and little needle component. Rates of spread decline because needle decay and concentrations of heavy material break up the continuity of fine fuels. Resistance to control remains high, however, because fire line production rates are typically slow with so much heavy fuel to cut through. Spotting is an extra concern due to many airborne firebrands.

Fire and Fuels – Direct/Indirect Effects

Alternative 1 (No Action)

Under this alternative, no new activities would occur in this planning cycle. Untreated portions of the project area would be expected to continue to grow new surface and ladder fuels. Canopy closure would increase over time. Potential for surface fires to transition to the forest canopy would increase as ladder fuels increase and torching indices decrease. Presence of more available fuel at the canopy layer would cause crowning index to decrease, resulting in increased potential for crown fire.

Increased fire hazard rating, which is based on a combination of torching and crowning indices, reflects increased flammability. Existing fire hazard ratings were calculated using the Forest Vegetation Simulator (FVS) and fire hazard rating tables. As shown in Table 41, about 57 percent of the project area has low or medium ratings, with the remaining 43 percent in the high or very high category. Spatial distribution is displayed on Map 6 in Appendix 1. Objective 10-01 is currently being met. By the year 2023, however, about 60

percent of the area is projected to be at the high or very high hazard levels. This figure would be expected to increase to 68 percent by 2027 and more than 75 percent by 2034.

Table 41: Existing Fire Hazard Summary

Fire Hazard Rating	Acres	% of Project Area
Low	6,573	29.3%
Medium	6,201	27.6%
High	5,971	26.6%
Very High	3,700	16.5%

Alternatives 2, 3, and 4

Silvicultural treatments and fuel reductions would be applied to reduce stand density, decrease fire hazard, lower susceptibility to infestation by mountain pine beetle, enhance diversity, and produce wood fiber. The objective of the proposed fuel treatments is to reduce horizontal continuity of fuels across the landscape, vertical continuity of fuels (ladder fuels), and the amount of fuel available to carry a wildfire.

Prescribed burns would generally take place in the fall of the year approximately three years after commercial treatments are conducted. Fires would be low- to moderate-intensity broadcast burns, scorching a maximum of 20 percent of the canopy mass. This treatment, applied alone or following mechanical thinning, would be effective in returning treated forested stands to a fire regime more closely aligned with natural conditions. Broadcast burning does more to return acres to Condition Class 1 than most non-burning treatments. Newly burned stands would need to be burned again within about 35 years to reach Condition Class 1, according to the Phase 2 Amendment definition.

Relative to fuels, the most important difference among alternatives is the proposal in Alternatives 3 and 4 to re-burn some or all of the Adams and Bald-Carnegie prescribed burn units, which were completed in October 2005. The intent would be to perpetuate the existing low level of fire hazard and the potential fire type as surface. Maintenance burning generally carries less risk of escape than the first burning entry. The importance to Fire Condition Class would be in legitimately converting the re-burned areas to Condition Class 1, because the return interval would be reestablished within the historical range.

Alternatives 3 and 4 would establish a trend toward uneven-aged stand structure in stands treated with group selection. Uneven-aged structure can mean that ladder fuels are present, indicating that crown fire transition might occur more readily. Under these alternatives, however, the canopy would be unlikely to carry a sustained crown fire due to space between trees. Occasional torching might still occur, but serious damage to the overstory canopy would not be expected.

Alternative 4 includes 1,259 acres of understory mulching. This treatment would involve chipping or shredding existing natural fuels and pine reproduction, fuels that would probably be consumed or killed with low-intensity understory burning. Treated areas would be expected to show a trend toward improved Condition Class, but Condition Class 1 might not be attained because of the lack of fire return intervals within the

historical range.

Reduction in overall fire hazard would be similar under Alternatives 2, 3, and 4. Improvement compared to the existing condition would be achieved by moving areas with high or very high hazard ratings to the low or medium category. Under Alternative 2, low and medium hazard acres would increase by 36 percent. Alternatives 3 and 4 would increase low and medium hazard acres by about 45 percent (see Table 42 and Maps 7-9 in Appendix 1).

Table 42: Fire Hazard Rating Summary for Alternatives 1-4

Fire Hazard Rating	Alternative 1 - No Action (acres)	Alternative 2 (acres)	Alternative 3 (acres)	Alternative 4 (acres)
Low	6,573	10,806	13,349	13,821
Medium	6,201	6,599	5,159	4,765
High	5,971	3,277	2,302	2,225
Very High	3,700	1,678	1,550	1,548

Table 43 compares acreage of potential crown fire type by alternative. Surface fire is considered preferable due to ease of suppression. Acreage of potential surface fire would increase to a similar degree under all action alternatives (12 percent under Alternative 2, 13 percent under Alternative 3, and 14 percent under Alternative 4). Area of potential active crown fire would decrease from 115 acres to zero under all action alternatives, while acreage of potential passive crown fire would decrease by 50 to 60 percent. These calculations assume similar weather and fuel conditions under all scenarios.

Table 43: Potential Crown Fire Type Summary for Alternatives 1-4

Fire Type	Alternative 1 - No Action (acres)	Alternative 2 (acres)	Alternative 3 (acres)	Alternative 4 (acres)
Active Crown Fire	115	0	0	0
Passive Crown Fire	4,200	2,144	1,830	1,715
Surface	18,129	20,215	20,529	20,647

Fire and Fuels – Cumulative Effects

The cumulative effects analysis area for fuels and fire resources is the project area plus a buffer of up to one mile outside the project area boundary. For this application, activities that occurred prior to 1997 are considered to have contributed to the existing condition. These boundaries were chosen for this analysis because the adjacent Riflepit timber sale and mountain pine beetle infestations just outside the project area boundary could indirectly affect fuels and potential fire line intensities.

Timber harvest is occurring in the project area in the Coyote and Wish timber sales. The Coyote sale has been active sporadically since it was sold in 1999. The effect on the fuels and fire resource has been the creation of a few mechanical harvester piles over a relatively long period. Mechanical harvester piles consist of the branch and top wood brought to the landings during a whole-tree yarding harvesting operation. Twelve of these piles were disposed of (burned or chipped) within the last year. If the Coyote timber sale continues to be harvested at this pace, brush disposal activities will continue for another five years or more. In this case, fuels would be created and disposed of gradually, and the

addition to fuels and fire hazard in the analysis area would be minimal.

The Wish timber sale, which was sold in 2001, has likewise seen little activity. The portion of the sale that is in the Moskee project area will probably generate less than five mechanical harvester piles. Therefore, Wish sale brush disposal and timber stand improvement work are likely to have little impact on fuels and fire hazard.

The Riflepit timber sale is active directly east of the project area. Silvicultural and fuel treatments planned under this project within one mile of the Moskee boundary are shown in Table 44.

Table 44. Riflepit Project Silvicultural and Fuel Treatments within One Mile of the Moskee Project Area

Silvicultural Treatment	Acres	Fuels Treatment	Acres
Various shelterwood cuts	415	Whole tree yard required	220
Commercial thinning	330	Lop and scatter permitted	175
Precommercial thinning	40	Lop and scatter with underburn	150
		Prescribed burn only	275

The combination of these actions would be expected to moderate potential fire growth rates and severity. Under the no action alternative, these parameters would remain essentially stable for five to 10 years in the absence of disturbance such as widespread mountain pine beetle infestation, but would be expected to increase rapidly beyond that timeframe. By adding to cumulative effects, Alternatives 2, 3, and 4 would be expected to further reduce fuels and fire hazard and to maintain these conditions further into the future.

Livestock grazing occurs in the cumulative effects analysis area as described on page 75. There are no additional allotments on NFS lands within one mile of the project area boundary. Grazing occurs on non-NFS lands to the west and south of the project area. Grazing systems and seasons of use vary. Livestock grazing would be expected to continue to reduce fine fuels as described above, though this effect is more pronounced in open meadows than the forested stands relevant to this discussion. Alternatives 2, 3, and 4 would temporarily increase understory production in treated areas due to a reduction in forest density, and this may increase distribution of livestock. More dispersed use by livestock would be expected to add slightly to the cumulative reduction of fine fuels in forested stands. Because this use would occur in managed stands, it would not be expected to add to cumulative effects on ladder fuels or fire hazard.

Ongoing mountain pine beetle infestation in the eastern and southern parts of the cumulative effects analysis area has caused patches of overstory mortality. If the Riflepit sale is harvested relatively quickly, pine beetle spread may be checked. If the sale is spread out over five to 10 years, prevention may be less effective. Resulting beetle populations could move into the Moskee area and cause fuel hazards and fire suppression difficulties described earlier. Alternative 1 would not add to the effects of recent activities, as most stands in the project area would remain at moderate or high risk of infestation. Alternatives 2, 3, and 4 would add to cumulative effects of harvest that has been completed, decreasing the chance of these fuel accumulations.

Noxious Weeds

Noxious Weeds – Affected Environment

About 80 percent of NFS lands in the Black Hills National Forest are infested with varying levels of noxious weeds (USFS 2003). Human-caused disturbances, including timber harvesting, recreation, mining, grazing, road development, and fire, have historically contributed and continue to contribute to the introduction, establishment, and spread of noxious weeds. Any ground disturbance can cause noxious weeds to spread from existing infestations or for new species to colonize. Many noxious weeds out-compete native and other desirable species because they are early-succession species, can be allelopathic[7] , produce abundant seed, grow rapidly, and have the ability to exploit the soil profile for nutrients and water. Many noxious weed species have no natural enemies and are not palatable to grazing animals (Sheley and Petroff 1999).

Inventory and treatment of noxious weeds is ongoing in the project area. All treatment is done under the 2003 Black Hills National Forest Noxious Weed Management Plan. The environmental analysis under which this plan was developed covers all NFS lands and cooperative jurisdictions within the Black Hills National Forest boundary. The plan states that the actual areas to be treated will be those areas where ground-disturbing activities result in noxious weed infestations.

Mature stands of timber are common in the project area, creating large contiguous areas of similar structure. This provides the potential for wildfire and beetle infestation. Both could play a role in noxious weed spread. The following noxious weeds (Table 45) have been observed in the project area, although no inventory has been conducted to date.

Table 45: Noxious Weeds Found in the Project Area

Species (Common Name)	Scientific Name
Canada thistle	*Cirsium arvense*
Common tansy	*Tanacetum vulgare*
Houndstongue	*Cynoglossum officinale*
Spotted knapweed	*Centaurea maculosa*
Leafy spurge	*Euphorbia esula*
Common mullein	*Verbascum thapsus*
Musk thistle	*Carduus nutans*
Whitetop	*Lepidium* spp.
Yellow toadflax	*Linaria vulgaris*

Noxious Weeds – Direct/Indirect Effects

Alternative 1 (No Action)

[7] Allelopathic plants produce chemicals that inhibit growth in other plant species.

Under Alternative 1, no new Federal actions would occur this planning cycle. Ongoing activities such as road maintenance and inventory and treatment of noxious weeds would continue. The potential for spread or increase of weeds in the Coyote and Wish timber sales is addressed by design criteria and mitigation measures prescribed by the relevant environmental analyses. Chemical treatment is scheduled on 254 acres in the Coyote sale and 31 acres in the Wish timber sale. Retreatment is planned over four additional years in each sale.

The large, contiguous stands of timber would remain unchanged. This provides the potential for wildfire and beetle infestation. Both could play a role in noxious weed spread. An increase in downed timber from beetle kill would increase the potential for wildfires to spread and burn with increased intensity, creating large areas of bare ground on which weeds could establish and compete with species that are more desirable. 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. Fires expose ground surfaces, reduce shade and increase light, and create a flush of nutrients (Goodwin et al. 2002). As a result, weed infestations would be expected to increase due to their ability to recover more quickly than native plants. Removal of a rhizomatous weed's top growth by fire stimulates production of new shoots from the vegetative root buds. Because of nutrient reserves in the roots, these new shoots are immediately aggressive and highly competitive (Goodwin et. al. 2002). Canada thistle, common tansy, and leafy spurge are rhizome-spreading noxious weed species present in the project area.

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

Alternatives 2, 3, and 4

Design criteria (see Chapter 2) and weed treatment included with these alternatives would reduce the likelihood of introduction of new species and substantial spread of existing infestations. With the level of activities proposed in this project, however, weeds would be likely to appear in new areas. The persistence of potential new and existing infestations depends in large part on availability of funding for treatment of noxious weeds.

An increase in infested acres resulting from proposed activities would have negative impacts both ecologically and economically. An increase in acres of infestation means a direct increase in cost. Ecologically, noxious weeds indirectly affect wildlife and livestock as they displace native vegetation and reduce the ability of ecosystems to function properly. This impacts mostly grass/forb communities, specifically riparian areas, upland grasslands, and meadows. When these areas become infested with noxious weeds, forage for wildlife and livestock is reduced (see Rangeland section, page 75).

Because actual acres of infestation have not been inventoried, the following estimate (based on page III-192 of USFS 1996) of potential noxious weed infestation is expected from Alternatives 2, 3, and 4 (Table 46). New road construction and road decommissioning are assumed to result in 0.12 disturbed acres per mile of road. Road reconstruction is also included.

Table 46: Proposed Activities and Potential Noxious Weed Infestation by Alternative

	Alternative			
Activity/Potential Infestation	**1**	**2**	**3**	**4**
Mechanical treatments with potential to cause ground disturbance (acres)	0	6,250	7,967	8,635
Estimated noxious weed infestation resulting from mechanical treatments (acres)	0	219	279	302
Road work (miles)	0	76.9	83.2	82.2
Estimated noxious weed infestations resulting from road work (acres)	0	9	10	10
Total area affected (acres)	0	228	289	312

Additional acres may be infested because of prescribed fire. Dozer lines, hand lines, staging areas, and areas burned so that mineral soil is exposed are susceptible to weed infestation. At this time there is no way to estimate acres infested as a result. Many variables, such as soil temperature, fire intensity, and time of year, determine the effects prescribed fire has on noxious weeds. While beneficial to forest health, fire can also be conducive to the spread of noxious weeds. Broadcast burning is proposed to be low-intensity, but there would probably be pockets of higher-intensity fire that could result in exposure of mineral soil and loss of understory herbaceous species. The loss of existing grasses and forbs provides an opportunity for weeds to become established. Many noxious weed species are very competitive and may prevent re-establishment of desirable grasses and forbs. Seeding of these areas would be required. Pre-treatment of weed infestations prior to prescribed fire implementation is important to reducing the risk of spread. 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. Therefore, the acreage totals in Table 46 may be low. This is true particularly for Alternative 3, which includes 3,630 acres of prescribed burning plus an additional 2,820 acres of reburn. Alternative 4 has the least potential with 1,661 acres of prescribed burning.

Closure of MA 4.1 to off-road motorized vehicle use may reduce the potential for spread of weeds in the closure area. This closure is proposed under all action alternatives.

Alternative 4 may have slightly greater potential than Alternative 3 to increase noxious weed infestations due to the largest proposed area of mechanical activity. When prescribed fire is included in the total activity acres, Alternative 3 may have the greatest potential for noxious weed infestation of all action alternatives.

Noxious Weeds – Cumulative Effects

The cumulative effects analysis area for noxious weeds is the project area plus private land inholdings. Acres of infestation on private land are unknown. The time span for the

cumulative effects analysis of noxious weed is five to 10 years. These spatial and temporal boundaries were chosen because effects in these areas overlap in time and space. Previous and foreseeable activities such as timber harvesting, off-road vehicle use, road construction and maintenance, and livestock concentration around water sources appear to have resulted in a cumulative effect of widespread infestation by noxious weeds. 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. Based on the limited information available, activities and effects on private land appear to be much the same as those on NFS lands.

Noxious weeds have been and will continue to be treated under previous and ongoing projects. According to the Coyote timber sale K-V plan, there are approximately 254 acres of noxious weeds requiring chemical treatment. The Wish timber sale includes chemical treatment of 31 acres of noxious weeds.

Table 47: Potential Cumulative Noxious Weed Infestation Following Implementation of the Moskee Project

Sources of Noxious Weed Infestations (acres)	Alternative			
	1	2	3	4
Moskee project	0	228	289	312
Coyote timber sale	254	254	254	254
Wish timber sale	31	31	31	31
Cumulative Total (acres)	**285**	**513**	**574**	**597**

Alternatives 3 and 4 have the greatest potential for an increase in noxious weeds, cumulatively. There is no estimate of acres of infestation available on private lands.

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

All action alternatives are likely to add to cumulative effects on weed infestation. Design criteria and weed treatment would reduce the likelihood of introduction of new species and substantial spread of existing infestations. With the level of treatment proposed and probable resulting ground disturbance, however, weeds are likely to appear in new areas. The persistence of these new and existing infestations depends in large part on availability of funding for treatment. Alternatives 3 and 4 would be the most costly to implement. If funding is not available, the chance of noxious weed spread increases.

Social Environment

Land Uses, Recreation, and Travel Management

The "land uses" resource area addresses special uses by groups, individuals, or other agencies. Special uses may include wells, waterlines, phone lines, electrical lines, communication sites, road easements, and certain livestock grazing situations.

The recreation resource includes both developed and dispersed recreational activities. Developed recreation refers to facilities constructed for public enjoyment, such as campgrounds. Dispersed recreation includes activities that occur across the landscape such as trails, camping, driving for pleasure, and hunting.

Travel management addresses opportunities for motorized and non-motorized travel. The Forest Plan directs that motorized travel in management area 4.1 is to be limited to designated routes and that "generally the road system will be closed to motorized travel" (Guideline 4.1-9102). In management area 5.1, motorized travel is generally allowed both on and off roads.

Land Uses, Recreation, and Travel Management – Affected Environment

There are currently special use permits for telephone lines and powerlines in the project area. A permit has also been issued to a private landowner to use NFS road 805 for winter access. The Forest Service has acquired several private land easements to access NFS lands.

There are no developed recreation facilities in the project area. There are about 10 miles of designated snowmobile trails and one outfitter-guide permit.

The designated snowmobile trail system is located on NFS and unclassified roads closed to wheeled vehicles between December 15 and March 31. The main access point for winter activities in the project area is along US Highway 85 in South Dakota, approximately three miles from the project area. At other times of the year, some of the roads used as snowmobile trails are open to wheeled vehicles. There are no other designated trails (defined as routes less than 50 inches wide) in the project area.

The following discussion of effects analysis for lands, recreation, and travel management resources is limited to the Moskee project area, including the discussion of cumulative effects.

Land Uses and Recreation – Direct/Indirect Effects

Alternative 1 (No Action): Land uses and recreation would be expected to continue. Fire hazard and risk of epidemic mountain pine beetle infestation would be expected to increase over time. A stand-replacing fire could affect land uses by threatening utility lines. Damage to these systems could disrupt service to residents of the area and cost thousands of dollars to repair. Fire or beetle infestation could affect snowmobile trails by altering scenery and increasing the number of dead trees, which could block trails or endanger users. In the absence of these events, Alternative 1 would not be expected to affect land uses or recreation.

Alternatives 2, 3, and 4: With implementation of design criteria requiring protection of permitted improvements such as utility lines (page 14), Alternatives 2, 3, and 4 would not be expected to affect land uses. Proposed activities would be expected to reduce fire hazard and risk of beetle infestation, decreasing the risk of damage to utility lines.

During and immediately after vegetation treatments, those using the project area for recreational activities may view the treatments negatively. Timber harvest can cause ground disturbance and change the landscape's appearance. Logging slash, whether scattered or piled, is often viewed unfavorably. Mechanical treatments are proposed on the largest area under Alternative 4, which may have the greatest effect, and the smallest under Alternative 2. Prescribed burning results in blackened ground and understory vegetation and occasional red-needled trees. Burning is proposed on the largest area under Alternative 3 and the smallest under Alternative 4. Within three to five years of completion, however, forest management activities are generally not evident to most visitors (see also Scenery section, below).

Proposed activities could also benefit recreation resources in the project area. Reducing the density of timber stands results in a more park-like atmosphere that many visitors find pleasing. The openness of the forest improves sight distance into the woods for the casual recreationist, providing a better opportunity for viewing wildlife.

Many of the main access roads likely to be used for timber hauling are also used for snowmobiling. The main snowmobile trail is on NFS road 875 ("Trail 3"). Winter logging could pose a hazard to snowmobilers. Even when roads are properly signed (page 14), the possibility of truck/snowmobile collisions exists.

Travel Management – Direct/Indirect Effects

Alternative 1 (No Action): Alternative 1 would not affect travel management. Roads currently open would remain open unless closed through another project. MA 4.1 would remain open to off-road use. Motorized use would not be displaced to other areas.

Alternatives 2, 3, and 4: Alternative 2 would decommission 25 miles of unclassified roads and 0.5 mile of NFS road. Alternatives 3 and 4 would decommission 26 miles of unclassified roads and the same 0.5 mile of NFS road. Unclassified roads are often user-created routes, or they may have been used in the past for timber harvest or other resource management activities. Some are the original route of system roads that were relocated to protect resources. Decommissioning activities could include recontouring the road surface, revegetating with native species such as grasses or trees, or blocking with debris. The photo above shows a typical road being considered for decommissioning. The objective of decommissioning is to prevent a road from being used by motorized vehicles, generally in order to protect resources such as soil, water, or wildlife.

A user-created road in the Moskee project area. This road travels through a bottomland meadow and is an example of the type of road proposed for decommissioning. Method could include disking and planting to native grasses for meadow enhancement. Placement of signs at entrance and exit points may discourage use.

One possible effect of decommissioning roads, particularly those considered unclassified or user-created, is the reduction of opportunities for motorized recreation.

Management area 4.1 would be closed to off-road motorized use under all alternatives. This would reduce off-road motorized opportunities by 23 percent (5,161 acres) in the project area. Levels of off-road motorized use appear to be highest during fall hunting seasons. Motorized hunters who typically use this area may be displaced or would have to travel by foot to access their favorite hunting areas.

Alternatives 2, 3, and 4 are relatively equal in providing access across the project area. Recreation opportunities would be unlikely to change substantially as a result of proposed activities.

Land Uses, Recreation, and Travel Management – Cumulative Effects

The cumulative effects analysis area for land uses is the project area, because permitted uses would be affected only by actions in their immediate vicinity. The cumulative effects analysis area for recreation and travel management is bounded by Cold Springs Canyon, US Highway 85, Riflepit Canyon, and Rattlesnake Canyon (approximately 47,100 acres). This area was chosen because actions and conditions on land adjacent to the project area may affect recreation in the project area, and vice versa. The time span for the cumulative effects analysis of recreation, lands, and travel management is 1997 through 2017 to allow for completion of proposed activities.

Past, present, and foreseeable activities have positively affected permitted land uses by reducing fire hazard. Alternatives 2, 3, and 4 would add to this cumulative effect while Alternative 1 would not.

The proposed land exchange involving parts of the project area (see page 30) would not be expected to affect land uses or travel management. The scattered NFS parcels proposed for conveyance would probably no longer be available for public use, but more acres would be gained than lost in the project area. None of the alternatives would add to this effect.

Recreation and travel management have been affected by past activities. In 2005, a large parcel of private land immediately west of the project area, known locally as the Moskee property, was sold. This property had been owned by Homestake Mining Company (later a subsidiary of Barrick Gold) for over 100 years, and many local residents were accustomed to using it as if it were public land. The new owners do not allow public use,

and this use has presumably shifted to nearby areas, including the Moskee project area. The action alternatives may further concentrate use, particularly for motorized hunting, through closure of MA 4.1 to off-road motorized use.

All NFS lands in the cumulative effects analysis area are currently open to off-road motorized use. The Calvert Sacket "ATV only" area (2,707 acres) is located in the cumulative effects analysis area. In this area, roads are closed to passenger vehicles but may be used by ATVs. Closure of MA 4.1 to off-road motorized use may result in a slight increase in off-road use elsewhere in the cumulative effects analysis area, including lands to the east in South Dakota.

The Coyote project decreased open road miles in the analysis area from 100 to 85 miles. These closures are located in MA 4.1. All action alternatives would add to this effect by decreasing open miles from 85 to 48 miles. If effective, these closures may displace use to other areas or cause users to find other means of access.

Scenery Management

Scenery Management – Affected Environment

Scenic integrity is a measure of the degree to which a landscape is visually perceived to be complete. The highest scenic integrity ratings are given to those landscapes that have little or no deviation from the character valued by constituents for its aesthetic appeal. Scenic integrity in the Moskee project area varies by location and depends on a number of factors. In addition to the variety of natural aspects of the scenic resource (geology, vegetation, landforms), human developments affect the scenic conditions of some areas. These developments include roads, vegetation management, and range facilities such as fences and water tanks.

Scenic integrity is classified as High (little visible evidence of human activities), Moderate (appearance slightly altered), or Low (appearance moderately altered). Timber harvest, prescribed fire, and other vegetation management activities have occurred in the project area. Human activities are evident in the foreground of many roads. The middle ground viewed from these roads appears slightly altered due to these activities. The project area maintains a natural appearance when viewed in the background from main roads and private land outside the project area. The project area's existing scenic integrity is generally High when viewed as the background, Moderate or High when viewed as middle ground, and Moderate as foreground.

Scenic integrity objectives (SIOs) are a set of measurable goals for management of forest scenic resources. In the Moskee project area, four percent of NFS lands should meet an SIO of High, 53 percent Moderate, and 43 percent Low.

The low, broad ridges typical of the area's topography limit visibility of project area landforms. The upper third and tops of some ridges are visible in the background from major travelways, including Interstate 90 and US Highways 85 and 585. Due to the relatively flat terrain, patterns of vegetation are not readily apparent from this distance.

Approximately 68 percent of the NFS lands within the project area are visible from less sensitive travelways, including Crook County Road 141 and NFSRs 105, 107, 175, 805, 807, 872, 875, and 876.

Typical view along a Sensitivity Level 2 road within the planning area. (USFS, July 31, 2006)

Designated snowmobile trails within the planning area include trails 3, 3A, and 3B. These trails are part of the Black Hills snowmobile trail system, which has trailheads in Wyoming and South Dakota.

The project area has rolling terrain with small, often linear meadows and limited exposed rock formations. Ponderosa pine is the dominant forest type, mixed with pockets and stands of aspen and other hardwoods. Vegetation alterations are scattered throughout the area. Perennial water features are generally limited to springs. Currently there is one residence in the project area.

Wildfires have occurred in the area, including the 1936 Moskee Fire (7,174 acres), and the 2005 Cement Fire (61 acres in the project area). The Moskee Fire area is currently forested primarily with aspen. In 2003, a prescribed fire along NFSR 875 killed patches of forest, resulting in areas of red-needled trees and blackened ground.

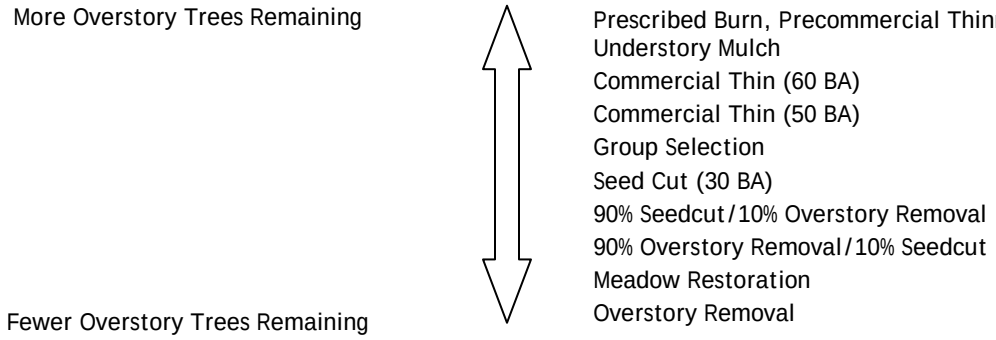
Main roads through the project area have generally been accepted over time as part of the positive cultural landscape character attributes. Past vegetation treatments generally tend to blend in with the landscape. Relatively flat topography and the nature of past management activities have combined to maintain the mostly natural appearance of the forest.

Scenery Management – Direct/Indirect Effects

Alternative 1 (No Action): Appearance of the project area would continue to be governed primarily by natural processes. Wildland fires would continue to be extinguished as quickly as possible, limiting the ecological role of fire and visual evidence of the effects of fire. As a result, forest density would be expected to continue to increase, reducing visibility. Any wildfires in dense pine stands with ladder fuels could burn into the canopy, killing mature trees. In the Moskee project area, hardwoods such as aspen are likely to reforest these openings. Larger burned areas could be highly visible on the landscape, especially in winter. These areas may or may not be similar in shape and size to meadows and other existing openings. Widespread tree mortality due to wildfire or mountain pine beetle infestation may not meet High or Moderate SIO. In these areas, large numbers of downed trees would probably dominate the landscape. Fire- or beetle-caused openings of less than 10 acres in a mosaic of tree sizes and openings would move toward the desired condition.

In areas where no disturbance occurs, competition for light, water, and nutrients may decrease occurrence of hardwoods and understory vegetation. Scenic variety may decrease. This dense vegetation also provides the greatest potential for disturbance (fire or insect) that could greatly change the appearance of the landscape.

Alternative 2: Vegetation treatments that leave most large trees intact can usually blend into the characteristic landscape. Treatments that remove most or all large trees are generally the most visible. The following diagram compares proposed treatments according to level of mature tree removal.



Alternative 2 proposes two relatively large, contiguous areas of overstory removal/shelterwood seed cut treatment:

- Units 284, 294, 346, 347, and 366 (258 acres)
- Units 544, 552, 560, 565, 571, 574, and 578 (418 acres)

These units are located on the tops and sides of gently sloping ridges. The treatment would result in relatively large, contiguous, open areas with scattered groups of large trees and an understory of pine seedlings and saplings. Understory pine would be precommercially thinned, adding to the open appearance. These areas may appear similar in form, texture, and scale to areas affected in the past by large wildfires. Due to the distance from primary travelways and use areas (Guideline 5610) and the fairly flat terrain, these units would be expected to achieve the assigned SIO.

Other proposed treatments would also be expected to meet assigned SIOs. Table 48 shows that a large majority of the treatments are proposed in areas of Low or Moderate SIO. The only sizeable acreage of treatment proposed in areas of High SIO is commercial thinning, which would meet the assigned SIO within a year of completion due to retention of most overstory trees and regrowth of understory vegetation. The mix of treatments should create a variety of tree sizes and spacing within the natural range of vegetative patterns (Guidelines 5605, 5611). These treatments should also reduce the potential for stand-replacing wildfires and mountain pine beetle attacks, which may have negative effects on scenic integrity.

Table 48 displays acres of each proposed treatment type by SIO class.

Table 48: Acres of Proposed Treatments by Alternative and SIO Class

Activity	Alt 2 (acres)			Alt 3 (acres)			Alt 4 (acres)		
	H SIO	M SIO	L SIO	H SIO	M SIO	L SIO	H SIO	M SIO	L SIO
Commercial Treatments									
Commercial Thin to 60 BA	48	958	978	48	1,008	853	48	560	439
Commercial Thin to 50 BA	92	534	662	32	633	569	32	633	530
Group Selection	0	0	0	8	424	433	8	905	845
Seedcut/Overstory Removal	0	215	91	0	468	542	0	495	515
Seedcut	0	302	350	2	300	385	0	300	385
Overstory Removal/ Seedcut	1	615	416	0	949	558	2	601	553
Overstory removal	0	46	79	0	107	133	0	0	0
Total	**141**	**2,670**	**2,576**	**90**	**3,889**	**3,473**	**90**	**3,494**	**3,267**
Non-Commercial Treatments									
Prescribed burn	5	1,285	2,621	97	2,645	3,606	43	715	903
Pre commercial thinning	1	877	586	2	1,455	1,300	2	1,115	1,049
Understory mulch	0	0	0	0	0	0	0	610	649
Total	**6**	**2,162**	**3,207**	**99**	**4,100**	**4,906**	**45**	**2,440**	**2,601**

Aspen and other hardwoods may spread and become more visually dominant following proposed treatments, increasing the potential for fall color across the landscape. The greatest potential for this to occur would be in hardwood restoration, overstory removal, and overstory removal/seedcut units.

Alternative 3: Compared to Alternative 2, Alternative 3 includes an additional group of overstory removal/shelterwood seedcuts that have contiguous units, appearing as a large opening:

- Units 406, 422, 424, 425, 428, and 446 (193 acres)

These units would have a similar effect as discussed under Alternative 2. Treatment acreage by SIO is shown in Table 48.

Alternative 3 would use group selection treatments to move stands toward an uneven-aged structure (Guideline 5611). Groups of trees would be cut to promote pine regeneration. The remainder of the stand would be thinned. This treatment method would meet a Moderate to High SIO. Over time, this silvicultural system would produce stands with a high level of structural diversity found in few other locations in the project area, increasing visual variety.

Proposed broadcast burning would benefit the scenic resource by removing dead plant material and slash and stimulating the growth of plants, shrubs and hardwoods. This would increase sight distance, visual diversity, and fall color. For one to three years after a burn, ash and blackened tree bark may be clearly evident across the landscape. Normally, these burn marks are no longer visible once new grasses and other vegetation grow the following spring. Underburning can meet High to Low SIOs, depending upon burn intensity. Observations suggest that most prescribed burn areas conducted in the Black Hills meet a High SIO within one year.

Other proposed treatments would have effects similar to those discussed for Alternative 2.

Alternative 4: This alternative includes fewer large blocks of overstory removal/shelterwood seedcut than the other alternatives and no pure overstory removal. It includes additional group selection treatments. Effects of the individual treatments would be similar to those of Alternative 3. Treatment acreage by SIO is shown in Table 48 above. Overall, Alternative 4 would alter stand conditions across a larger area than the other alternatives, but the degree of change would be less due to reduced acreage of treatments incorporating overstory removal. The larger area of uneven-aged management would result in a greater degree of scenic diversity.

Alternative 4 proposes understory mulching using machinery to crush and chop understory pine into small pieces. Moisture level stays higher when slash is at ground level, resulting in more rapid decomposition. The initial effect of this treatment can be an obvious alteration in the appearance of the forest floor, with pieces of cut wood and bark commonly seen. Experience indicates that an SIO of Moderate or High can be met within one to three years of treatment as grasses, forbs, and hardwoods quickly respond to increased light and moisture.

All action alternatives would meet assigned SIOs within the timeframe specified by Guideline 5606.

Scenery Management – Cumulative Effects

The cumulative effects area for scenery management is the project area, because this identified area is the landscape that is evident in the foreground and middle ground from the main travel routes. The time span for the cumulative effects analysis of scenery management is from 1980 to 2047 to account for past activities that are still affecting scenery resources, completion of all activities included in the Moskee proposals, and future uneven-age management entries.

Under all alternatives, activities planned under the Coyote and Wish timber sales would continue. Activities would take place primarily in areas with Low SIO. Effects of these activities are expected to meet the assigned SIO within one to three years of completion of the activities.

The potential Moskee land exchange would prevent subdivision and development of scenic open meadows along NFSR 875.1.

Alternative 1 (No Action): The no action alternative would not add to cumulative effects of past, present, and foreseeable actions described above.

Alternatives 2, 3, and 4: Under all action alternatives, proposed activities would overlap actions planned under the Coyote and Wish timber sales. Some of the proposed actions overlap each other.

Effects of activities related to these timber sales that would overlap spatially and temporally with the effects of the proposed activities include diversification of tree spacing and size in pine stands and an increase in open areas and hardwood forest. These effects would decrease as pine stands grow and spread. The proposed activities would add to the effects of the previous and ongoing projects, offsetting forest succession and

maintaining or increasing forest diversity.

Because activities related to the Coyote and Wish timber sales have met or will meet assigned SIOs within the timeframe specified by Guideline 5606, and proposed activities and future uneven-age entries would meet assigned SIOs, the action alternatives would not have a cumulative effect on scenic integrity.

Heritage

Heritage – Affected Environment

There are four heritage sites eligible to the National Register of Historic Places (NRHP) in the Moskee project area, including sites 48CK527, 48CK704, 48CK1635 and 48CK1833/39LA1162 (this site has two identifiers because it is located in Wyoming and South Dakota). Sites 48CK527 and 48CK704 are multi-component sites with historic and prehistoric elements; 48CK1635 is a lithic scatter, and 48CK1833/39LA1162 is a large springside base camp with a chert procurement area.

Heritage – Direct/Indirect Effects

Alternative 1 (No Action): Under Alternative 1, no new activities would occur. Changes may occur through ongoing activities (such as road maintenance), natural processes, or other management decisions in the future. This alternative does not provide mitigation measures, resource protection, or stabilization of currently affected sites. If forest stand densities remain high, potential for large, high-intensity crown fires would also remain elevated. Such a fire may damage and/or destroy heritage resource sites in its path through soil erosion and exposure to the elements. Effects also may include compromised radiometric dates, damage to rock features and rock art due to heat spalling[8], and destruction of wooden structures and features.

Alternatives 2, 3, and 4: See Chapter 2 for design criteria (based on Forest Plan Standards and Guidelines) that would be incorporated into Alternatives 2, 3, and 4 to protect heritage resources during implementation of these alternatives. These design criteria would be expected to result in no effect to known NRHP-eligible or unevaluated sites. If unknown sites are present, proposed activities could cause damage. Potential for damage is, however, expected to be low, as ground-disturbing activities would be required to cease upon discovery of new heritage resources until a qualified archaeologist has examined the site.

Heritage – Cumulative Effects

The cumulative effects area for heritage is considered the project area. The time span for the cumulative effects analysis of heritage is the length of the project activities.

Alternative 1 (No Action): Coyote and Wish timber sales are not known to have adversely affected any NRHP-eligible or unevaluated site. Ongoing and foreseeable activities will be conducted in compliance with Forest Plan Guideline 6101 and therefore would not be expected to adversely affect NRHP-eligible or unevaluated sites. Continued off-road motorized vehicle use could add to cumulative effects of previous disturbances

[8] Cracking of rocks due to high heat

at heritage sites.

Alternatives 2, 3, and 4: These alternatives are not expected to affect known, NRHP-eligible or unevaluated heritage sites. Inadvertent damage to unknown sites would be expected to be minimal, but could add to cumulative effects.

Consultation

The Forest consults with the Wyoming State Historic Preservation Officer (SHPO) and various Tribal Historic Preservation Offices (THPOs). The heritage resources inventory report for the Moskee planning area was received by the Wyoming SHPO and the Cheyenne River Sioux Tribal Historic Preservation Office on April 18, 2007. Reports sent to THPOs also request additional recommendations for the protection of any known American Indian spiritual use sites. If a site is eligible or has been identified as a sacred site, heritage personnel consult with Tribal government officials and the appropriate SHPO on protection, avoidance, or mitigation measures. The heritage specialist may also request field visits by Tribal representatives to identify and verify sacred site locations.

Per 36 CFR 800.4(d)(1)(i), if the SHPO or THPOs do not object within 30 days of receipt of an adequately documented finding, the agency official's responsibilities under 106 are fulfilled. The Wyoming SHPO concurred with the determination of "no historic properties affected" on May 24, 2007.

The Forest also consulted with the THPOs for the Standing Rock Sioux, Rosebud Sioux, Ogallala Sioux, and Three Affiliated Tribes during the initial project scoping. These tribes have requested that heritage resource inventories with identified Adverse or No Adverse Effects be submitted to their offices.

Environmental Justice

Executive Order 12898 (February 11, 1994) directed Federal agencies to identify and address the effects of actions with disproportionate effects on minority or low-income populations. No such communities have been identified in the project area. Analysis for this environmental assessment identified no effects or issues specific to any minority or low-income population or community. The agency has considered all input from persons or groups regardless of age, race, income status, or other social and economic characteristics.

Socioeconomics

Socioeconomics – Affected Environment

Figures generated by economic analysis of timber projects are usually used as a means to compare alternatives (rather than as an absolute measure) because timber prices tend to fluctuate widely. For example, average sawtimber stumpage price in the Black Hills was $228.00 per thousand board feet in 1999, while the current value is about $75.00 per thousand board feet. It is not possible to predict the selling price of a future timber sale, even though the actual economic efficiency of this project depends on that prediction.

Socioeconomics – Direct/Indirect and Cumulative Effects

Economic analysis of Alternatives 2, 3, and 4 using current stumpage rates indicates that costs would exceed revenues. Various costs and benefits were not included in this analysis. Some of these, such as recreational activities, take place across the Forest and the Black Hills region. Recreation has an economic effect on local communities, but there is insufficient information to determine this specific project's contribution to this effect. Fuel reduction projects are often costly in the short term, but the cost of a wildfire that may have been prevented by the fuel reduction could be exponentially higher. This benefit cannot be fully taken into account in economic analysis. Other non-market factors, such as the value of habitat for rare species, are problematic to quantify and compare directly to commodities.

The economic analysis was generated using QuickSilver, a Forest Service economic analysis program customized for the Rocky Mountain Region and the Black Hills National Forest. Present net value (the future benefit of the project discounted to the present) is -$3,191,212 for Alternative 2, -$6,135,449 for Alternative 3, and -$3,333,334 for Alternative 4. The benefit/cost ratio is .33 for Alternative 2, .25 for Alternative 3, and .37 for Alternative 4, indicating costs to the government would exceed direct monetary returns under all action alternatives.

The Black Hills area economy was dominated by mining, timber harvest, and agriculture for many years. The region's economy is now well diversified, but the future of some timber operators in the highly competitive forest products industry continues to be uncertain. The proposed actions would contribute to the local economy by producing forest products and employment and through procurement of services and products associated with project implementation.

ACRONYMS AND REFERENCES

Acronyms

AMD	Average Maximum Density
ASQ	Allowable Sale Quantity
ATV	All-Terrain Vehicle
BA	Basal Area
BA	Biological Assessment
BE	Biological Evaluation
BMP	Best Management Practice
BTU	British Thermal Unit
CDA	Connected Disturbed Area
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWU	Common Water Unit
DBH	Diameter at Breast Height
EA	Environmental Assessment
EPA	Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FSM	Forest Service Manual
FVS	Forest Vegetation Simulator
GIS	Geographical Information System
HUC	Hydrologic Unit Code
ID	Interdisciplinary
IRI	Integrated Resource Inventory
KV	Knudson-Vandenberg
LRMP	Land and Resource Management Plan
MA	Management Area
MFI	Mean Fire Interval
MIS	Management Indicator Species
MMBF	Million Board Feet
MMCF	Million Cubic Feet
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFPA	National Fire Protection Assessment
NFS	National Forest System
NFSR	National Forest System Road
NRHP	National Register Of Historic Places
NRIS	National Resource Information System
NWI	National Wetlands Inventory
POL	Products Other than Logs
R2	Region 2 of the US Forest Service (Rocky Mountain Region)
RMBO	Rocky Mountain Bird Observatory
RMRS	Rocky Mountain Research Station
SHPO	State Historic Preservation Office
SIO	Scenic Integrity Objective
SOLC	Species of Local Concern
SS	Structural Stage
THPO	Tribal Historic Preservation Office

TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
WCPH	Watershed Conservation Practices Handbook
WGFD	Wyoming Game and Fish Department
WUI	Wildland-Urban Interface
WYNDDB	Wyoming Natural Diversity Database

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Modeling Sources

BEHAVEPlus 3.0, Beta 1, released Dec. 2004: http://fire.org

NEXUS 2.0, released March 2001: http://www.frames.gov/tools/

Forest Vegetation Simulator (FVS) and Stand Visualization System (SVS) with the Fire and Fuels Extension (FFE), Central Rockies Variant: http://www.fs.fed.us/fmsc/fvs/

First Order Fire Effects model (FOFEM), version FOFEM5, http://www.frames.gov/tools/

Simple Approach Smoke Effects Model (SASEM), version 6.0.84.50., March 26, 1999; http://www.frames.gov/tools/

Individuals, Groups, Tribes, and Agencies Consulted

Backcountry Horsemen of America (Lee or Carol Yake)
Joe Baron, Crook County Attorney
Bearlodge Snowmobile Association
Biodiversity Conservation Alliance
Black Hills Forest Resource Association (Aaron Everett)
Black Hills Land Analysis (Rob Mattox)
Bureau of Land Management (Alice Tratebas)
Cher Burgess
Crook County Commissioners (Floyd Canfield, Chairman)
Crook County Growth and Development
Congresswoman Barbara Cubin
Dakota Territory Cruisers/Black Hills 4-Wheelers (Greg Mumm)
Charles Edwards
U.S. Senator Michael Enzi
Nancy Hilding
Jesse Hoese, Hoese Cattle Company, Inc.
Homestake Forest Products, Inc.
Motorized Recreation Council of Wyoming (J.R. Riggins)
National Wild Turkey Federation (Randy Gaskins)
Native Ecosystems Council (Sara Jane Johnson)
Native Ecosystems Council (Brian Brademeyer)
Sara Needles, Wyoming State Historic Preservation Officer
Neiman Sawmill
Norbeck Society (Colin Paterson)
The Nature Conservancy (Bob Paulson)
Richard and Ellen Plocek
Pope & Talbot, Inc. (Jim Hoxie)
Prairie Hills Audubon Society
H. Blayne and Karen J. Pummel
Rocky Mountain Elk Foundation (Larry Baesler)
Sierra Club, South Dakota Chapter (Sam Clauson)
Sierra Club, Wyoming Chapter (Todd Herreid)
State Senator Mark Semlek
State Planning Coordinator’s Office
Sundance Rod and Gun Club
Joe and Lavenda Termes
U.S. Senator Craig Thomas
State Senator Chuck Townsend
Trailhead Mountain Bike Club (Ken Denzin)
Tom Troxel
Lauris Tysdal
U.S. Fish and Wildlife Service (Brian Kelly)
Tom and Susan Vore
Lloyd and Phyllis Watson
Watson Land LLC
Gary Welke
Wyoming Division of Forestry (Bill Kohlbrand)
Wyoming Game and Fish Department
Wyoming Stock Growers Association (Jim Magagna)

Wyoming Trail Riders Association (Sam Wegner)
Wyoming Trails Program

Cheyenne River Sioux Tribe, Albert Lebeau, Tribal Historic Preservation Officer
Cheyenne River Sioux Tribe, Harold Frazier, Tribal Chairman
Cheyenne River Sioux Tribe, Raymond Uses The Knife, Tribal Vice-Chairman
Cheyenne/Arapaho Tribes of Oklahoma, Darrell Flyingman, Chairman
Cheyenne/Arapaho Tribes of Oklahoma, Gordon L. Yellowman, Cultural and Heritage Program
Crow Creek Sioux Tribe, Lester Thompson, Jr., Chairman
Eastern Shoshone Tribe, Ivan Posey, Tribal Chairman
Flandreau Santee Sioux Tribe, Mark Allen, Tribal Chairman
Grey Eagle Society, Mrs. Elaine Quiver
Kiowa Ethnographic Endeavor for Preservation, Dewey D. Tsonetokoy, Sr.
Lower Brule Sioux Tribe, Michael Jandreau, Tribal Chairman
Lower Brule Sioux Tribe, Scott Jones, Cultural Resource Office
Northern Arapaho Business Council, Richard Brannan, Tribal Chairman
Northern Arapaho Tribe, Joanne White, Tribal Historic Preservation Officer
Northern Cheyenne Tribe, Conrad Fisher, Tribal Historic Preservation Officer
Northern Cheyenne Tribe, Eugene Little Coyote, President
Northern Cheyenne Tribe, Joe Little Coyote, Sr., Tribal Planner/Director
Oglala Sioux Tribe, Charles White Elk, Tribal Historic Preservation Officer
Oglala Sioux Tribe, Cecilia Fire Thunder, President
Oglala Sioux Tribe, Harvey White Woman
Rosebud Sioux Tribe, Rodney Bordeaux, President
Rosebud Sioux Tribe, Russell Eagle Bear, Tribal Historic Preservation Officer
Santee Sioux Nation, Roger Trudell, Tribal Chairman
Sicangu Lakota Treaty Council Office, Rosebud Sioux Tribe, Sicangu Treaty Council
Sisseton-Wahpeton Sioux Tribe, Scott German, Tribal Vice-Chairman
Southern Arapaho Tribe, William Pedro, Southern Arapaho NAGPRA, NHPA
Spirit Lake Sioux Tribe, Ambrose Little Ghost
Spirit Lake Sioux Tribe, Valentino White, Tribal Chairman
Standing Rock Sioux Tribe, Tim Mentz, Sr., Tribal Historic Preservation Officer
Standing Rock Sioux Tribe, Ron His Horse Is Thunder, Tribal Chairman
Three Affiliated Tribes, Elgin Crows Breast, Cultural Preservation Office
Three Affiliated Tribes, Tex Hall, Tribal Chairman
Three Affiliated Tribes, Pamina Yellowbird, Cultural Resource Office
Yankton Sioux Tribe, Robert Cournoyer, Tribal Chairman

Preparers

This section lists the individuals who worked on this EA, as well as their titles and roles. Not all team members served simultaneously.

Name	Position	IDT Role
USDA Forest Service, Black Hills National Forest		
Carol Agard	Archeologist	Team member
Lance Asherin	Silviculturist	Team member
Janis Bouma	Planner	Team leader
Susan Corey	Botanist	Team member
Steve Keegan	Landscape architect	Team member
Kelly Koistinen	Civil engineer	Team member
Steve Kozel	Bearlodge district ranger	Line officer
Elizabeth Krueger	District planner	Support
Dennis Mauch	Fuels specialist	Team member
Kim Morales	Hydrologist	Team member
Steve Mott	Silviculturist	Team member
Deanna Reyher	Soil scientist	Support
Matt Stefanich	Wildlife biologist	Team member
Julie Wheeler	Range management specialist	Team member
USDA Forest Service, TEAMS Enterprise		
Sue Wingate	NEPA Specialist	Team leader