Biological Environment

Forest Vegetation

Affected Environment:

Existing Silvicultural Conditions

Background

The approximate 60,371-acre project area includes 44,766 acres of National Forest land and 15,605 acres of State and private lands. The National Forest lands are in five management areas.

Table 1 - Forest Plan Management Areas (RMRIS data, GIS acres)

Category	Management Area	Acres
3.31	Backcountry Motorized Recreation Emphasis	426
3.32	Backcountry Non-motorized Recreation Emphasis	1,644
5.1	Resource Production Emphasis	11,604
5.2A	Fort Meade VA Hospital Watershed	3,299
5.4	Big Game Winter Range	27,793

Table 58 displays timber suitability associated with the Forest Planning process. The suitability determination was used in developing the allowable sale quantity and does not imply that timber harvest would be limited to these lands. Unscheduled commercial harvest may occur on unsuitable lands to meet other multiple use objectives where provided for in standards and Guidelines (USDA Forest Service 1997).

Table 2 - Timber Suitability (RMRIS data, GIS acres)

Code	Suitability	Acres
511	Suitable: Roaded Upland Forest, Tractor Logging	3,835
521	Suitable: Unroaded Upland Forest, Tractor Logging	808
522	Suitable: Unroaded Upland Forest, Cable Logging Area	253
591	Suitable: past wild-fire	1,122
640	Suitable: visual emphasis	857
650	Suitable: wildlife emphasis	23,223
660	Suitable: water emphasis	2,421
710	Unsuitable: stocking within 5 years cannot be assured	276
721	Unsuitable: topography prevents harvesting by tractor or cable systems	2,557

Code	Suitability	Acres
722	Unsuitable: irreversible resource damage to soils productivity or watershed conditions is likely to occur with harvest due to unstable soils	342
801	Tentatively Suitable: Managed for Other Multiple Use Objectives, Late Successional Site	594
810	Tentatively suitable: experimental forest, range, or watershed	418
820	Tentatively suitable: uneconomical	347
821	Tentatively suitable: steep slopes	1,773
822	Tentatively suitable: aspen	1,650
823	Tentatively suitable: road construction problem prevents access development	503
824	Tentatively suitable: isolated patch of forest land	160
826	Tentatively suitable: oak	311
832	Tentatively suitable: hardwoods	46
871	Tentatively suitable: back-country recreation	1,738
891	Tentatively suitable: pine converted to aspen	474
892	Tentatively suitable: pine converted to meadow	236
Blank	Grasslands and Non-Forested Lands	822

Cover Types

Cover type is the current forest vegetation that dominates a site. The Elk Bugs and Fuels project area has five forest cover types: ponderosa pine, aspen, white spruce, other hardwoods, and three non-forest cover types: grass, rock, and non-forest. Ponderosa pine is, by far, the most common cover type on the project area. The following table shows the area in each forest and non-forest cover type.

Table 3 - Forest Cover types (RMRIS data, GIS acres)

Cover Type	Acres	% of N.F. Lands
Aspen	1,650	4%
Bur oak	311	<1%
Other hardwoods	46	<1%
Ponderosa pine	41,624	93%
White spruce	313	<1%
Grass	657	1%
Non-forest or Unknown	165	<1%

Habitat Types

Habitat type is the basic unit in classifying lands or sites based on potential, or climax natural vegetation. Climax vegetation is that which has attained a steady state with its

environment. All stands of climax vegetation that have the same overstory and understory dominants are grouped into a single plant association. Plant associations are the fundamental units of plant community classification. Series is the next higher category of classification. Habitat types with the same potential climax dominant are grouped into series (Alexander and Hoffman 1987).

Table 4 - Habitat Types and General Characteristics

(RMRIS data; Johnston 1987)

Code	Plant Association	Description	Acres	% Of Project Area Forested Acres	Dominant Tree Species
01102	*Pinus ponderosa/ Schizachyrium scoparium-Elytrigia smithii*	Rocky breaks, hills and canyons, and watercourses, precipitation 18-20 inches per year, 4,800-5,500 feet elevation, pH 7.2-8.0, often derived from limestone.	579	1%	Ponderosa pine
01104	*Pinus ponderosa/Bouteloua curtipendula*	Rough, stony land and canyon rims on exposures of limestone and limey sandstone, pH 7.3, sandy loams.	201	<1%	Ponderosa pine
01108	*Pinus ponderosa/ Danthonia intermedia*	Shale, granite, or limestone, precipitation 18-20 inches per year, 4,950-5,500 feet elevation.	1,886	4%	Ponderosa pine
01110	*Pinus ponderosa/Festuca idahoensis*	Well-drained loamy sand or sandy loam, gentle s-w aspects, pH 5.5-6.7, 4,300-6,000 feet elevation.	100	<1%	Ponderosa pine
01112	*Pinus ponderosa/ Juniperus communis*	Silt loam, shallow soil, pH 5.1-6.8, 4,575-6,525 feet elevation.	5,334	12%	Ponderosa pine

01113	*Pinus ponderosa/ Juniprus communis-Symphoricarpos albus*	Mesic uplands, limestone plateau, 5,670-6,780 feet elevation. Higher elevation, moist, cool sites.	6,505	15%	Ponderosa pine
01115	*Pinus ponderosa-Juniperus scopulorum/Cercocarpus montanus*	Low elevation, more exeric ponderosa pine sites, sw-se slopes, precipitation 18-20 inches per year, limestone soils, 5000-5500 feet elevation	775	2%	Ponderosa pine-Rocky mountain juniper
01119	*Pinus ponderosa/Physocarpus monogynus*	North aspects, 5140-5700 feet elevation.	78	<1%	Ponderosa pine
01120	*Pinus Ponderosa/Purshia tridentata*	Well-drained dry benches, dry slopes, 10-55%, predominately south aspects, sandy loams, PH 5.0-6.6.	30	<1%	Ponderosa pine
01122	*Pinus ponderosa/Padus virginiana*	Low-elevation, moist north facing slopes and draws, calcareous or non calcareous gravelly silt loam to silt loam soil, precipitation 20-22 in., pH 6.0-9.0.	16,142	37%	Ponderosa pine
01123	*Pinus ponderosa/Spiraea betulifolia*	Loamy sand or loam soils, pH 5.9-7.1, mesic sites at higher elevations, 6100 feet elevation.	1,021	2%	Ponderosa pine

01124	*Pinus ponderosa/ Symphoricarpos albus*	Moderately steep slopes, mesic sites on non-calcareous soil, loam to silty clay loam, precipitation 20-22 inches per year. PH 5.1-6.4, 3,720-6000 feet elevation.	2,989	7%	Ponderosa pine
01126	*Pinus ponderosa/Carex heliophila*	Rocky ridges and dry southerly slopes, foothills on borders and ridges I the plains, 4500-5170 feet elevation, precipitation 20 inches per year. PH 5.8-6.9.	271	<1%	Ponderosa pine
01140	*Pinus ponderosa/Arctostaphylos uva-ursi*	Gentle to steep lower slopes and ridges, all aspects, moderately deep to lithic soils, very dry and well drained, variety of textures, pH 4.7-6.7. Undergrowth is often sparse, elevation 5080-6700 feet.	3,966	9%	Ponderosa pine
01151	*Pinus ponderosa/Quercus macrocarpa*	Rolling hills and ridge-tops, calcareous substrates in the northern Black Hills, sandy loams to clay loams, pH 5.3-6.0, elevation 4750-5300 feet.	1,879	4%	Ponderosa pine-bur oak
0501	*Picea glauca/Carex peckii*	Upper canyons, north end of Black Hills, cool, damp, northeast aspects, soils rocky, with low to moderate clay content, moderately deep to deep.	2	<1%	White spruce

0502	*Picea glauca/Juniperus communis*	Cool, wet, uplands, silty loam soils, 17-57% n-w slopes, acid soils, PH 5.3-5.5.	2,546	6%	White spruce
0503	*Picea glauca/Linnaea borealis*	Northerly moderately steep (28-63%) slopes, loam soils, pH 5.4-7.3, elevation 5800-6430 feet.	1,068	2%	White spruce
10202	*Ostrya virginiana/Crataegus succulenta*	Woody draws; small springs which flow from the clay layer in canyons, springs in deep canyons.	7	<1%	Eastern hophornbeam, paper birch, quaking aspen
10203	*Ostrya virginiana-quercus macrocarpa/sparse understory*	Moderately steep (28-47%) northerly slopes, sandy loam and loam soils, pH 5.8-7.4, elevation 3000-3500 feet.	99	<1%	Eastern hophornbeam, bur oak
10402	*Populus sargentii-P. angustifolia*	Low elevation riparian sites.	36	<1%	Plains cottonwood and narrowleaf cottonwood
10502	*Populus tremuloides/ Corylus cornuta*	Well developed, deep soils from limestone, quartzite, shist, and tertiary volcanic, mostly northerly aspects, pH 5.7-6.2, elevation 4000-6150 feet.	841	2%	Quaking aspen/paper birch
10801	*Betula papyrifera/Corylus cornuta*	Nearly level draws or top of draws, sandy loam or silt loam, pH 6.8-7.6, 0-30% north facing slopes.	119	<1%	Paper birch/bur oak/quaking aspen

Ponderosa Pine

Much of the ponderosa pine cover type regenerated in the late 1800s or early 1900s after heavy logging and/or wildfires. Timber stands supplied early settlers with logs and lumber for homes and buildings, railroad ties, mining timbers, and fuel wood (USDA Forest Service 1996). Stands are predominately even-aged, with remnant over-mature trees that survived wildfires and logging. Table 61 displays the age-class of aspen, ponderosa pine, and white spruce stands based on stand year-of-origin. Year-of-origin is from RMRIS data and calculated by RMRSTAND, acres are from RMRIS.

Table 5 - Cover Type Age-Class Based on Stand Year-Of-Origin (RMRIS data)

Decade of Origin	Aspen (Acres)	Ponderosa Pine (Acres)	White Spruce (Acres)
1680-1689	0	51	0
1750-1759	0	29	0
1760-1769	0	0	0
1770-1779	0	95	0
1780-1789	0	47	0
1790-1799	0	134	0
1800-1809	0	150	0
1810-1819	0	281	0
1820-1829	0	359	0
1830-1839	0	389	0
1840-1849	0	653	0
1850-1859	0	1,297	0
1860-1869	0	2,564	0
1870-1879	0	3,612	60
1880-1889	6	5,964	0
1890-1899	258	8,103	33
1900-1909	160	7,255	29
1910-1919	113	4,747	113
1920-1929	161	3,374	70
1930-1939	65	1,262	4
1940-1949	24	642	4
1950-1959	0	1,392	0
1960-1969	91	451	0
1970-1979	0	927	0
1980-1989	374	584	0
1990-1999	250	432	0
2000-2002	0	0	0
No Data	148	815	0

Stands vary from pure ponderosa pine on drier sites, to ponderosa pine mixed with white spruce, quaking aspen, paper birch, bur oak, and/or hophornbeam, locally known as ironwood. Drainage bottoms have eastern hophornbeam and bur oak on the lower elevation sites. White spruce, quaking aspen, and paper birch are common in north aspect ponderosa pine stands.

Twenty-seven % (11,094 acres) of the project area's ponderosa pine stands are stocked at or greater than 60% AMD (average maximum density). Sixty % AMD is the upper limit of the management zone for ponderosa pine based on the Region 2 Stocking Guide (USDA Forest Service 1997). Twenty-one % of the ponderosa pine stands are fully stocked between 40% and 60% AMD, and 18% are at less than full stocking, 40% AMD. In some areas, stand stocking has been reduced due to mountain pine beetle caused mortality. Table 62 displays stocking for all cover types throughout the project area.

Table 6 - Stocking by Cover Type Based on % of Average Maximum Density (AMD); Acres (% of cover type)

Cover Type	Under stocked 1-39% AMD	Fully Stocked 40-59% AMD	Overstocked 60%+ AMD	No Data
Aspen	715 acres (43%)	325 acres (20%)	0 acres	610 acres (37%)
Other hardwoods	0	0	0	46 (100%)
Ponderosa pine	7,582 (18%)	8,855 (21%)	11,094 (27%)	14,093 (34%)
White spruce	205 (65%)	62 (20%)	0	46 (15%)
Bur oak	5 (2%)	0	0	306 (98%)

Quaking Aspen

The quaking aspen cover type make up only 4% of the project area forest cover type, however aspen is a component of many ponderosa pine stands on northwest to east aspects throughout the project area. Aspen is a relatively short lived, shade-intolerant, pioneer species, which regenerates well after disturbance through vegetative sprouts (DeByle and Winokur 1985). The stands and inclusions became established, or re-established, due to stand replacing fire events near the turn of the last century and are in-decline. Aspen is climax on only 2% (841 acres) of the project area; the remainder of the aspen is seral to ponderosa pine or white spruce. Through time and with no disturbance, ponderosa pine and/or white spruce would gradually take over these sites.

Paper Birch

No stands in the project area have been identified with a paper birch cover type, however paper birch exists throughout the project area on north and east facing slopes and along drainage bottoms. Birch is found in pine, aspen, and oak stands. Like aspen, birch is a relatively short-lived, shade-intolerant pioneer species (USDA Forest Service 2002). Birch became established or re-established due to stand replacing fire events near the turn of the last century, and are now in decline. Birch is climax on less than 1% (119 acres) of the project area, and these stands likely have a current cover-type of aspen or oak, based on predominant stocking.

White Spruce

White spruce is dominant on only 313 acres of the project area, however it is common within the understory of ponderosa pine stands on moist sites throughout the project area. With no wildfire or other stand-replacing disturbance, the amount of spruce cover type will continue to increase across the project area. Wildfire, a common occurrence before the 1900s, limited white spruce to moist sites such as draw bottoms and steep north aspects. White spruce is climax on 8% (3,616 acres) of the project area. Where spruce is climax, it will become the dominant species if fire does not burn through the stand.

Bur oak

Bur oak occurs as an understory species associated with ponderosa pine, as a dominant shrub, or as individual trees in ravines and riparian areas along the edge of the Black Hills (Sheppard and Battaglia 2002). Bur oak is currently the dominant tree species on 311 acres. Bur oak is relatively shade intolerant, and regenerates through root and stump sprouts after wildfire.

Other Hardwoods

Stands classified as other hardwoods include mixed stands of bur oak and eastern hophornbeam (ironwood), aspen, and birch.

Insects and Disease

Mountain pine beetle (*Dendroctinus ponderosae*) is the number one insect killer of pines throughout the western United States. The beetle is a native species to the West and attacks most pine species, including ponderosa pine in the Black Hills (Allen et al. 2002).

The mountain pine beetle has one generation per year in the Black Hills. Adult flight occurs in July-August, when adults leave previously infested trees and attack un-infested, green trees. Attacking adults chew through the bark and construct galleries along which eggs are laid. Larvae hatch from the eggs and begin feeding on the phloem of the tree in late summer or early fall. Larvae, pupae, or new adults over-winter under the bark of the infested tree. In the spring, the beetle finishes its maturation process, producing the next

generation of adults. The larvae kill trees by feeding on the inner bark or phloem and cutting off sugar flow from the needles to the roots. The introduction of blue stain fungus by the beetles causes clogging of the water conducting tissues in the tree, speeding up the tree's death (Allen et al. 2002).

Mountain pine beetles generally infest ponderosa pine trees that are between 8 and 12 inches in diameter, although trees larger than 20 inches have been attacked (Sheppard and Battaglia 2002). Stand density is the driving factor of a potential outbreak of mountain pine beetle. Stands with basal area between 140 and 260 sq. ft. per acre are highly susceptible to beetle attack. Stands with basal areas between 80 and 120 are considered moderately hazardous, while stands less than 80 sq. ft. BA are considered to be at low risk for infestation. As stand density increases, the amount of competition between trees within the stand increases. This intense competition in high-density stands lowers a tree's resistance to beetle attack and represents a key feature in mountain pine beetle outbreaks (Sheppard and Battaglia 2002).

The ability of a tree to resist a mountain pine beetle attack has been linked to the amount of carbohydrates that can be utilized directly for defensive wound reactions. Environmental factors that restrict the size of a canopy or its photosynthetic efficiency weaken tree resistance. Drought can affect the carbon balance of a tree by halting photosynthesis, which depletes carbon reserves for defensive compounds and eventually reduces the size of the canopy. Tree vigor also decreases when live crown ration decreases to 30 % (Sheppard and Battaglia 2002).

Mountain pine beetle has always been a part of the Black Hills forest ecosystem, with outbreaks occurring periodically. There have been 5 or 6 major outbreaks of mountain pine beetles in the Black Hills over the past 100 years, each lasting about 10-15 years. Outbreaks of the beetle can cause considerable changes in forested stands, including a reduction in average stand diameter and density. Tree mortality levels of 25% can be expected throughout a landscape surrounding outbreak areas and levels of up to 50% or more can occur in heavily attacked stands (Allen et al. 2002).

The Beaver Park area and vicinity is currently experiencing a mountain pine beetle epidemic. The Beaver Park Roadless Area is outside the project area boundary, however this project area is adjacent to it on the north, west, and south sides. The number of trees killed per acre in Beaver Park is approaching totals that are above and beyond those reported for previous outbreaks in the Black Hills (Allen et al. 2002). Over 100 trees per acre have been killed in some parts of the Beaver Park area. Entire hillsides are now completely devoid of large trees. Many of the places that have the largest expanding populations are now outside of the Forbes Gulch area. Stand conditions in areas that have not already been affected by beetles remain conducive to sustaining high levels of beetle caused mortality. Those areas starting to decline in beetle infestation are those where most or all of the forest has already been killed (Allen et al. 2002). Beetles are starting to move out into surrounding Forest lands in the area. Places such as Vanocker Canyon, Park Creek, and Elk Creek Canyon are becoming heavily infested (Allen et al.). The project area is a mosaic of National Forest and lands of other ownership. Beetle caused mortality is occurring on National Forest and lands of other ownership

Ponderosa pine stands in the project area have been classified for mountain pine beetle risk. Stand susceptibility to beetle caused losses has been reduced due to beetle caused mortality in areas such as Forbes Gulch and Beaver Gulch, which are within the Beaver Park Roadless area. Stand hazard ratings give an indication of which stands are most likely to have initial beetle infestations. These ratings give no indication of local beetle pressure. Once an outbreak has started, any stands containing suitable host material are at risk (Allen et al. 2002).

Table 7 - Risk of Mountain Pine Beetle Caused Losses in Pine Stands (RMSTAND; GIS acres)

Risk Rating	Acres (% of pine stands)
No Rating (0)	1,583 (4%)
Low (1)	14,133 (34%)
Medium (3)	15,745 (38%)
High (5)	10,161 (24%)

The red turpentine beetle (*Dendroctinus valens*) attacks the base of trees and freshly cut logs and stumps of ponderosa pine. It is a native bark beetle. It is not an aggressive tree killer, but frequently weakens trees, making them susceptible to other bark beetles. Population may increase where logging has occurred for several consecutive years (Sheppard and Battaglia 2002). Turpentine beetle populations are endemic across the project area and associated mortality is limited.

The pine engraver beetles (*Ips spp.)*, native to the Black Hills, are potentially destructive in sapling and pole stands, although they are normally secondary insects. Pine engraver populations commonly develop in logging slash, especially if it is shaded or does not dry out quickly, or trees damaged by wind and snow. Fire scorched trees that still have suitable phloem are frequently attacked. Mortality in live trees is usually limited and risk is highest for trees 2-8 inches in diameter. Large trees that are attacked are often top killed by the pine engravers, while the lower bole is infested by other insects (Sheppard and Battaglia 2002).

Red rot (*Dichomitus squalens*), which causes a white-pocket rot, is one of the major causes for loss of sound wood in commercial stands. Both immature and mature, and vigorous and declining trees are susceptible to infection. The rot usually enters the tree through dead, bark covered branches (Alexander 1987). Red rot is common in stands throughout the project area, and the level of rot may be increasing due to snow damage to branches of live trees.

Western gall rust (*Endrocronarium harknessii*) can be found in ponderosa pine stands, however it is not a significant cause of tree mortality or deformity. Gall rust cankers kill branches, deform trees, and affect growth rates (Alexander 1987). Two areas of the

project area have relatively high levels of trees infested with gall rust: windy flats, in the southwest portion of the project area, and stands originating after the Big Elk Burn, in the southeast portion of the project area.

Shoestring root rot (*Armillaria*) is present in the project area. Research shows that *Armillaria* may make ponderosa pine susceptible to mountain pine beetle infestations (Alexander 1987). This association is probably true on the project area, as mountain pine beetle infested trees can be found in areas of shoestring root rot.

Wind and Snow

Ponderosa pine has a well-developed root system and is one of the more wind-firm species in the Rocky Mountains. Although wind is not a primary cause of damage, it can be damaging locally, especially in mature to over-mature stands during windstorms accompanied by heavy, wet snow (Alexander, 1987). Snowstorms in the fall of 1982, fall of 1998, and spring of 1999 caused considerable damage and mortality in ponderosa pine stands throughout the northeastern Black Hills. The heavy snow combined with wind resulted in broken treetops, and branches, bent sapling and pole size trees, and toppled trees.

Snags

The following table displays the average number of ponderosa pine snags per acre, 10 inches in diameter or greater, by aspect, in stands of ponderosa pine cover-type throughout the thirteen 7th order watersheds associated with the project area. The snag densities were calculated from RMRIS tree data. Ponderosa pine snags with a diameter greater than 9.9 inches were calculated for each watershed and aspect based on RMRIS tree data. Tree status of M, S, or D, diameter greater than 9.9 inches, and watershed total was calculated by a summation of TALLY*TREE_FACTOR*Ris_acres (USDA Forest Service 1998). Stands with no tree data were assumed to have no snags. Information regarding snag height is not available, and live trees with snag characteristics are not included.

Table 8 – Existing Pine Snags, 10" DBH and Larger (RMRIS Tree Data)

Watershed	Aspect	Snags/Acre
10120202060202	North	1.0
	South	1.83
10120202020105	North	3.36
	South	3.29
10120202060105	North	0.60
	South	1.18

Watershed	Aspect	Snags/Acre
10120202060106	North	2.27
	South	4.29
10120202060104	North	2.74
	South	2.39
10120202060103	North	3.01
	South	2.97
10120202070101	North	6.04
	South	5.21
10120111020301	North	2.87
	South	2.52
10120202060102	North	4.95
	South	3.06
10120111020103	North	1.78
	South	2.32
10120111020305	North	2.42
	South	2.06
10120202060202	North	1.08
	South	0.77
10120111020104	North	1.27
	South	1.66

Most watersheds do not meet Forest wide Standard 2301 for the number of snags 10" and greater. Watersheds 10120202070101 and 10120202060102 meet the Forest wide Standard 2301 for the number of 10". The watershed snag estimates are conservative, because they do not include recent mortality due to mountain pine beetle, or live trees with snag characteristics. In addition, there is a high probability that sites with no tree data have snags. In recent years there has been mountain pine beetle caused mortality across the entire project area, and beetle mortality is considered epidemic in the Beaver Park Roadless Area vicinity, including watersheds 10120202060106, 10120202070101, 10120111020301, 10120111020103, and 10120111020305.

Past and Planned Harvest

The district RIS database identifies forty-one timber sales within the Elk bugs and fuels project area since 1982. Timber harvest took place prior to 1982, but there are no records available. The following Table 65 shows the sale name and approximate years of harvest activity. Sales that are a result of recent legislation, Public Law 107-206 are not included. Salvage sales in the early 1980s harvested timber damaged during a snowstorm that occurred Columbus Day weekend, 1982.

Table 9 - Recent Timber Sales Within Elk bugs and fuels Project Area

Sale Name	Years of Harvest Activity	Sale Name	Years of Harvest Activity
Chicken	1982-1984	Tilford	1986-1993
Spring Run Salvage	1982-1983	Monument	1986
Polo Salvage	1982	Nasty	1986-1988
Hill Salvage	1983	Runkle	1986-1987
Rooster Salvage	1983	Kelly	1986-1990
Three Draws Salvage	1983	Dalton	1986
Virkula Salvage	1983	Hay	1989-1991
Tilford Salvage	1983	Lost	1989-1994
Pullet Salvage	1983	Pit Resale	1991-1992
Cave Salvage	1984	Cave	1992-1996
Crook Mountain Salvage	1984	Vanocker	1994-2000
Left Salvage	1984	Roost	1994-1997
Lost Salvage	1984	Boomer	1997-2000
Park Creek Salvage	1985-1987	Deadman	1997-2001
Pigtail Salvage	1985-1986	Kirk	1998-present
Red Hill	1985-1987	Pit	1998
Kirk Hill	1985	Piedmont	1999-present
Pine	1985	Boulder	2001-present
Polo	1985	Redhill	2002-present
Chicken Bugs	1985	Danno	2002-present
Sid Bugs	1985		

Table 66 lists the acres of vegetation treated in timber sales in the 1980s, 1990s, 2000s, and recently planned timber sales. This table does not include treatments planned and implemented under recent legislation, P.L. 107-206.

Table 10 - Acres of Vegetation Treatment; 1980s - Planned (RMRIS data)

Treatment Code	Treatment Description	1980s	1990s	2000s	Planned
4111	Clearcut	182	239	32	76
4121/4122	Shelterwood preparation	0	0	90	0
4131	Shelterwood seedcut	646	1749	100	188
4141-4143	Shelterwood removal and overstory removal	143	629	45	307
4152	Uneven-aged management – group selection	0	0	0	16
4220	Thin	8,840	3,634	51	7
4230	Salvage	1,700	0	0	0

4240	Special cut (aspen, aspen/birch maintenance and enhancement	0	0	50	58
4511/4521	TSI – Precommercial thinning	1,344	2,144	218	74
6104	Habitat improvement - tree encroachment control	0	0	13	264
6108	Regenerate aspen – clearcut	458	356	7	54
6109	Tree encroachment control	0	321	40	103
	Total Acres Treated by Decade (% of Forested Area)	13,313 (30%)	9,072 (21%)	646 (1%)	1,147 (3%)

Grizzly Gulch Fire

The Grizzly Gulch Fire of June and July of 2002 burned 11,589 acres of which 3,315 are National Forest. Almost half of this fire, 5,608 acres, burned within the Elk Bugs and Fuels project boundary; 3,025 acres of National Forest lands and 2,583 acres of other ownership. National Forest lands within the project area that burned were mostly forest vegetation, with ponderosa pine, aspen, or aspen-birch cover types. Vegetation mortality followed levels of fire severity. Mortality of trees on National Forest lands within the project area was mostly low to moderate, with high mortality, greater than 60%, on approximately 240 acres (Garbish, B 2002). Areas of high mortality were pine stands on steep, rugged slopes with little or no past treatment. No commercial timber salvage is planned on National Forest lands.

Logging Systems

The project area would be planned for harvest with conventional, ground based harvest operations and skyline yarding. Conventional harvest equipment operations would be hand felling with chainsaws and the use of rubber tired skidders to yard wood to the landing, where it would be bucked to length and loaded on trucks for transport to the mill. Unless expressly prohibited, other ground based logging systems would be acceptable, including mechanical felling with equipment such as tracked feller-bunchers, and cut-to-length systems. Skyline yarding brings logs to a road by means of a suspended cable system. Skyline yarding is typically used in areas with slopes greater than 35%. Road systems for skyline yarding need to be well placed to access the timber, and logs are usually pulled uphill.

Environmental Consequences:

Direct and Indirect Effects

Alternatives 1, 2, 3, and 4

Forest Insects

Chances for pine engraver beetle caused mortality would increase with all alternatives. Pine engraver beetle's primary host is fresh slash, wind-thrown trees (Sheppard and Battaglia 2002), fire-killed trees, and the treetops of mountain pine beetle killed trees (Allen, K. personal communication.). Depending on weather conditions and the continuity of harvest and post-treatment operations, a large population of beetles could build up in slash. Stressed trees could be successfully attacked. Proper slash treatment and timing of post-sale treatments in alternatives 2, 3, and 4, would minimize losses and the pine engrave beetle would not pose a problem (Allen, K. personal communication.). Slash treatments which minimize build-up of beetle populations include: limb and lop slash to less than 18" depth, whole-tree-yarding, and breaking the continuity of vegetation treatments to break the "green chain" or supply of suitable bark beetle habitat. The biggest producers of pine engraver beetles are those trees infested by mountain pine beetle. Treatments that lower mountain pine beetle risk and treat beetle-infested trees would decrease pine engraver beetle populations, even if they create slash (Allen, K. personal communication.).

Proposed treatments in Alternatives 2, 3, and 4, would decrease the risk of mountain pine beetle caused losses in ponderosa pine stands. Risk of mountain pine beetle caused losses could continue with Alternative 1 until beetle caused mortality decreases suitable habitat. There are large populations of mountain pine beetles in the project area and vicinity, and suitable habitat to sustain beetle populations.

Stands are considered to be most susceptible to mountain pine beetle caused losses when 75% of the stand is in the 7-13 inch diameter range and stand density is over 120 feet of basal area per acre (Stevens et al. 1980, Schmid and Mata 1992). Stand risk ratings are based on stand structure, average stand diameter, and stand density. High-risk stands are single storied, have a large average diameter, and high density. Stand hazard ratings give an indication of stands most likely to have initial beetle infestations. Once an outbreak has started, any stands containing suitable host material are likely to incur damage. The reduction of risk in stands is temporary, and risk increases with stand growth. Thinned stands can be expected to reach the high-risk category in 13-50 years (Obedzinski et al. 1999) depending on the residual stocking and site quality. The following table displays the post treatment risk rating of ponderosa pine stands. Risk was calculated using the RMSTAND program for stands with tree data. Recently treated stands and stands planned for treatment were rated based on estimated stand structure, average tree diameter, and stand density, following guidelines from the Rocky Mountain Forest and Range Experiment Station (Stevens, et al. 1980).

Table 11 Post-Treatment Mountain Pine Beetle Risk

Risk Rating	Post-treatment Risk – Acres (% of PP Covertype)

	Alt. 1	Alt 2	Alt. 3	Alt. 4
Low	16,464 (40%)	17,274 (42%)	16,692 (40%)	17,303 (42%)
Moderate	16,219 (40%)	16,683 (40%)	17,190 (41%)	16,677 (40%)
High	8,941 (21%)	7,667 (18%)	7,742 (19%)	7,644 (18%)

Alternative 4 best reduces the risk of mountain pine beetle caused losses in ponderosa pine stands across the project area followed by Alternatives 2 and 3.

Sanitation of beetle-infested trees would occur in stands planned for commercial timber harvest. Beetle infested trees would be cut, removed, and debarked at a sawmill, killing the beetle population within the tree. This treatment can reduce mountain pine beetle populations in localized areas and individual stands, and provide some protection to surrounding trees and stands by removing a large source of attacking beetles (Allen and Long 2001). Sanitation would increase the likelihood of post-treatment stand stocking remaining at desired levels. Alternative 4 would treat the most area with sanitation and would be the most effective at reducing beetle populations in the project area, followed by Alternatives 2 and 3. Alternative 1 would do nothing to reduce beetle populations in the project area.

Bait and sanitation treatments would occur in Alternatives 2 and 4 at 8 locations. Mountain pine beetles in a local area would be concentrated using pheromone bait and destroyed through sanitation timber harvest. The baited tree and surrounding trees would be attacked. This treatment could reduce mountain pine beetle populations in localized areas and individual stands, and provide some protection to surrounding trees by removing a source of beetles. Bait and sanitation treatments would be more efficient than sanitation alone because the infested trees would be localized to facilitate their removal.

Mountain pine beetle caused mortality would likely continue in all alternatives, especially in dense, untreated pine stands. Mortality could be intense and extensive in these stands. Mortality in surrounding treated areas, should be less in Alternatives 2, 3, and 4 due to sanitation treatments which decrease beetle populations, and thinning which decreases stand risk. Alternative 4 would do the most to decrease mountain pine beetle caused mortality, followed by Alternatives 2 and 3.

Harvest Volume

Harvest volume for the alternatives is displayed in the following Table . The volumes are estimates based on stand exam data. Alternative 4 would harvest the most sawtimber and POL (products other then logs), followed by Alternative 2 and 3.

Table 12 - Harvest Volume by Alternative

Product	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Net Sawtimber – CCF	0	20,700	15,400	21,300
Net POL – CCF	0	14,500	9,700	14,900
Total Net Volume- CCF	0	35,200	25,100	36,200

The following table displays each alternative's harvest volume contribution to the forest Allowable Sale Quantity (ASQ) and non-ASQ volume from lands classified as tentatively suitable and unsuitable. Timber harvest is planned on lands classified as tentatively suitable and unsuitable. Harvest on these lands is not for timber commodity purposes; harvest would achieve other land management objectives: wildland fuel abatement and forest insect control.

Table 13 - ASQ Volume by Alternative

	Product	Net CCF Volume		
		Alt. 2	Alt. 3	Alt. 4
ASQ	Sawtimber	16,100	11,100	16,700
	Roundwood	10,300	7,100	10,600
Non-ASQ	Sawtimber	4,600	4,300	4,600
	Roundwood	4,200	2,600	4,300

Stands proposed for thinning, fuel breaks, sanitation, patch cuts, and hardwood restoration were not evaluated for culmination of growth. These practices are not subject to the CMAI findings because the treatments are exceptions permitted as sound silvicultural practices or meet multiple use objectives (36 CFR 219,16(2)(iii)).

Stand Structure and Stocking

Stand structure could gradually change through time in Alternative 1 or stand structure could change drastically due to mountain pine beetle mortality. Stands would continue to grow and increase in stocking. Mortality would occur in overstocked stands due to tree-tree competition, insect and disease caused mortality, and weather events such as windy, wet spring snowstorms. Beetle caused mortality could be extensive and light, with only a few trees killed per acre in any year, or mortality could be intensive, with stand mortality in the range of 50-100% of standing trees in areas several hundred acres in size. Stands with moderate to high beetle mortality would regenerate to pine, forming 1-3 storied stands, depending on overstory mortality. Hardwood stands and inclusions would continue to decline as ponderosa pine trees seed into hardwood stands and grow. Hardwoods would increase in areas with moderate to heavy mountain pine beetle mortality, especially on north slopes and along drainages.

The treatments proposed in Alternatives 2, 3, and 4 would change stand structures, dependent on the treatment. All proposed treatments would reduce the stocking of ponderosa pine, and increase hardwoods.

Table 14 Post Treatment Ponderosa Pine Stocking

Stocking	Alt. 1	Alt. 2	Alt. 3	Alt. 4
0-39 % AMD	17,129 acres	21,048 acres	20,335 acres	21,470 acres
40-59 % AMD	12,607	9,925	10,721	9,652
60+ % AMD	11,152	9,871	9,835	9,770

Thinning from below would reduce stocking of ponderosa pine stands. The largest trees with the best phenotype would remain and continue to grow. Stands would be more open, and there would be fewer small diameter stems. Alternatives 2 and 4 would thin stands to 80 sq. feet basal area, or ½ of their existing stocking, which ever is less. Alternative 3 would thin stands to 60-70 sq. ft. of basal area. Alternative 2 would thin 8,058 acres, Alternative 3 would thin 6,656 acres, and Alternative 4 would thin 8,381 acres. Thinned stands would appear as a forest of trees, however they would be fairly open, and most tree crowns would not be touching. Following harvest, thinned stands would appear fairly uniform in stocking, however stocking would vary within stands due to past disturbances such as areas of insect or disease caused mortality, or mortality due to weather. With time, within stand variation of stocking would increase due to variations in site quality and corresponding tree growth, and mortality due to insects, disease, and weather. Hardwoods, such as aspen and birch, present in the understory of thinned stands, would release, and coppice sprouts would be common, especially on moist north and east slopes.

The creation of shaded fuel breaks in Alternatives 2, 3, and 4 would also reduce the stocking of ponderosa pine stands. Treatments to create shaded fuel breaks would remove the smaller pines, and the largest trees with the best phenotype would remain and continue to grow. Patches of hardwood trees would have most of the pine removed. These stands would be more open than the thinned stands, and inclusions or pockets of hardwoods would be more evident. Alternatives 2, 3, and 4 would create 1,635 acres of shaded fuel breaks.

Hardwood restoration treatments would reduce ponderosa pine stocking within pine/aspen, pine/oak, and pine/aspen/birch stands through commercial harvest and non-commercial treatment areas. Reducing pine stocking slows the natural succession from hardwoods to pine, and decreases competition for light and nutrients. This improves the health and growth of the existing oak, aspen, or aspen/birch. Following treatment, hardwoods would be the dominant trees in these stands, with scattered mature and over-mature pines. Alternatives 2, 3, and 4 would treat 323 acres of hardwoods.

Burning is planned within the project area in alternatives 2, 3, and 4. Burning pine and mixed pine/hardwood stands would change stand structure. The proposed low-intensity underburning would kill most pine seedlings, with mortality decreasing with tree size. Underburning would also kill hardwoods, including oak, aspen, and birch, however these species would quickly sprout new stems from their existing roots. Seedlings may also

sprout in the exposed mineral soil. Pine stands would appear more open and uniform in tree size after burning, except where hardwoods exist. Where hardwoods exist, stand structure would increase. Alternative 3 proposes burning in 4,423 acres of pine covertype and alternative 4 proposes to burn 2,516 acres of pine covertype.

Burning hardwood stands would kill most standing, live trees. Oak, aspen, and birch would quickly sprout new stems and stands would appear as a dense stand of saplings, with scattered pines, within 1-3 years of the burn. Alternative 2 would underburn 87 acres of mixed birch and pine, Alternative 3 would underburn 174 acres of hardwoods and 3,032 acres of pine, Alternative 4 would underburn 175 acres of hardwoods.

Burning is also planned in meadows or grasslands where pine seedlings are common. Burning should kill a large number of these seedlings, and maintain the areas as grass. Alternative 2 would burn 252 acres of grasslands or meadows, Alternative 3 would burn 255 acres, and Alternative 4 would burn 252 acres.

Bait and sanitation treatments in Alternatives 2 and 4 would create openings within forested stands, 1/10 to several acres in size. These openings would reforest naturally, with seed from adjacent trees, within 5 years.

Beetle caused mortality would likely occur, especially in stands with high risk, as a large mountain pine beetle populations exists in the area. Stands with moderate to high beetle caused mortality would regenerate and become 1-3 storied stands. Stand structure changes due to beetle caused mortality would be expected to be less in Alternatives 2, 3, and 4, as compared to Alternative 1.

Even-aged Management of Ponderosa Pine

The use of even-age management is appropriate to meet the objectives of the Black Hill National Forest Land and Resource Management Plan. The preferred silvilcultural system for regenerating ponderosa pine on suitable lands is shelterwood (USDA Forest Service 1997).

Restocking Within Five Years

All stands proposed for silvicultural treatment can be adequately restocked within five years of final harvest. Stands in the vicinity with comparable site conditions have received similar silvicultural treatment and resulted in full stocking within five years of final harvest.

Stand Diversity

Natural succession and events such as wildfire, weather, and insects would determine stand diversity in Alternative 1. Without disturbance, age-class distribution of ponderosa pine stands would continue to move towards maturity and away from younger stages. Hardwood stands and inclusions would continue to decrease due to natural succession to

ponderosa pine. Pine trees would continue to encroach on grasslands, reducing diversity in the project area.

Low to moderate levels of mountain pine beetle caused mortality would increase stand diversity by creating small openings. Stands with high levels of beetle caused mortality would regenerate and create stand age-class diversity. Beetle caused mortality could reduce stand diversity, where mortality is high, over a large area. Large areas could regenerate to a single age-class of pine and result in stand conditions suitable for future mountain pine beetle outbreaks.

Alternatives 2, 3, and 4 are more likely to maintain beetle caused mortality at *endemic* levels that increase within-stand diversity. Thinning to decrease stand risk and sanitation to decrease beetle populations are likely to maintain beetle caused mortality as individual trees and small patches at the local level.

The within-stand diversity of ponderosa pine stands where hardwoods are present would increase through thinning and burning in alternatives 2, 3, and 4. Thinning and burning would stimulate coppice hardwood regeneration. While aspen, birch, and oak grow best in full sun, these species would sprout and survive in the understory and midstory of thinned or burned stands. Within stand diversity would decrease in pine stands with few or no hardwoods. Thinned or burned pine stands would appear more even-aged because there would be fewer understory trees.

Alternative 2, 3, and 4 would maintain 323 acres of hardwoods through the removal of conifers. Removing the conifers would slow the succession from hardwoods to pine. Maintaining hardwoods on these sites would maintain diversity across the project area.

Ponderosa pine trees are growing within and seeding adjacent meadows. Burning the meadows would reduce pine encroachment. Alternatives 2 and 4 would burn 252 acres of grass covertype and alternative 3 would burn 255 acres. Alternative 3 would take additional steps to decrease pine encroachment on grasslands. Pine seedlings, saplings, and pole size trees growing in meadows would be cut and slashed to maintain the area as grassland. Alternative 3 would treat pine within 170 acres of grasslands or mixed forest-grasslands. Alternative 3 would do the most to maintain meadows and grasslands, followed by alternatives 2 and 4.

Cumulative Effects

The area to be analyzed for cumulative effects are the eighteen 7th order watersheds that encompass the project area and activities undertaken due to Public Law 107-206. Cumulative actions will be analyzed in three parts: cumulative actions within the project area, cumulative actions outside the project area (within the eighteen 7th order watersheds), and snags and green tree retention, which will be analyzed on a watershed-by-watershed basis. Silvicultural treatments generally have minimal direct affect on adjacent stands and even less effect on stands in adjacent watersheds, other than indirect effects such as habitat for mountain pine beetle populations. Revised Forest Plan Standards 2301, 2302, and 2306 require analysis of snags and green tree retention on a watershed basis, so the eighteen watersheds that encompass the project area and activities undertaken due to Public Law 107-206 will be the area of analysis.

Project Area Cumulative Effects

The project area includes 44,766 acres of National Forest land and 15,605 acres of other ownership. Past actions to be analyzed for cumulative effects include those since settlement in the late 1800s. Reasonably foreseeable actions include those currently planned or actions that could be expected to happen within the next 20 years.

Past Actions

Past actions in the project area on National Forest, private, and other lands include timber harvest, wildland fuel management, fire suppression, grazing, mining, gravel production, recreation, firewood cutting, big-game management, road construction, railroad construction, subdivision of private lands and home construction, utility line construction and maintenance.

Field reconnaissance shows timber harvest occurred throughout the project area since settlement in the late 1800s, however there are no records available for treatment prior to the 1980s. Harvest included green sawtimber trees and dead standing "pitch pine" which was used for fence posts. Recent National Forest timber sales, since 1982, within the project area are listed in the following table. Salvage sales in the early 1980s harvested timber damaged during a snowstorm that occurred Columbus Day weekend, 1982.

Table 15 Recent Timber Sales within Elk Bugs and Fuels Project Area

Sale Name	Years of Harvest Activity	Sale Name	Years of Harvest Activity
Chicken	1982-1984	Tilford	1986-1993
Spring Run Salvage	1982-1983	Monument	1986
Polo Salvage	1982	Nasty	1986-1988
Hill Salvage	1983	Runkle	1986-1987
Rooster Salvage	1983	Kelly	1986-1990
Three Draws Salvage	1983	Dalton	1986
Virkula Salvage	1983	Hay	1989-1991
Tilford Salvage	1983	Lost	1989-1994
Pullet Salvage	1983	Pit Resale	1991-1992
Cave Salvage	1984	Cave	1992-1996
Crook Mountain Salvage	1984	Vanocker	1994-2000
Left Salvage	1984	Roost	1994-1997
Lost Salvage	1984	Boomer	1997-2000
Park Creek Salvage	1985-1987	Deadman	1997-2001
Pigtail Salvage	1985-1986	Kirk	1998-present
Red Hill	1985-1987	Pit	1998
Kirk Hill	1985	Piedmont	1999-2000
Pine	1985	Boulder	2001-present

Sale Name	Years of Harvest Activity	Sale Name	Years of Harvest Activity
Polo	1985	Redhill	2002-present
Chicken Bugs	1985	Danno	2002-present
Sid Bugs	1985	Public Law 107-206 Sales	2002-present

Past, Present and Reasonably Foreseeable Activities.

Table lists the acres of vegetation treated in National Forest timber sales in the 1980s, 1990s, 2000s, recently planned timber sales, and treatments planned and implemented under recent legislation, P.L. 107-206.

Table 16 Acres of Vegetation Treatment within Elk Bugs and Fuel Project Boundary; 1980s - Planned (RMRIS data)

Treatment Code	Treatment Description	1980s	1990s	2000s	Planned
4111	Clearcut	182	239	32	76
4121/4122	Shelterwood preparation	0	0	90	0
4131	Shelterwood seedcut	646	1749	100	188
4141-4143	Shelterwood removal and overstory removal	143	629	45	307
4152	Uneven-aged management – group selection	0	0	0	16
4220	Thin	8,840	3,634	51	3,975
4230	Salvage	1,700	0	0	0
4240	Special cut (aspen, aspen/birch maintenance and enhancement	0	0	50	58
4511/4521	TSI – Precommercial thinning	1,344	2,144	218	74
6104	Habitat improvement - tree encroachment control	0	0	13	264
6108	Regenerate aspen – clearcut	458	356	7	54
6109	Tree encroachment control	0	321	40	103
	Total Acres Treated by Decade (% of Forested Area)	13,313 (28%)	9,072 (19%)	646 (1%)	5,115 (12%)

Grizzly Gulch Fire

The Grizzly Gulch Fire of June and July of 2002 burned 11,589 acres of which 3,315 are National Forest. Almost half of this fire, 5,608 acres, burned within the Elk Bugs and Fuel project boundary; 3,025 acres of National Forest lands and 2,583 acres of other ownership. National Forest lands within the project area that burned were mostly forest vegetation, with ponderosa pine, aspen, or aspen-birch cover types. Vegetation mortality followed levels of fire severity. Mortality of trees on National Forest lands within the project area was mostly low to moderate, with high mortality, greater than 60%, on approximately 240 acres (Garbish, B 2002). Areas of high mortality were pine stands on steep, rugged slopes with little or no past treatment. No commercial timber salvage is planned on National Forest lands. Salvage is occurring on BLM managed lands and private lands.

Current Actions

Timber sales are currently under way on National Forest lands within the project area, and include Boulder, Redhill, Piedmont, Kirk, Cavern, Danno, and sales associated with Public Law 107-206. Livestock grazing occurs on National Forest and private land. Wildfires are suppressed. Subdivision and development of private land is taking place. Maintenance of roads, trails, and electric utility lines continues. Recreational activities include sightseeing, biking, use of all-terrain vehicles, and hunting. The State of South Dakota manages big game populations through regulated hunting.

Future Actions

Reasonably foreseeable future actions include continued development of private land, vegetation management on Federal and private lands, road and utility corridor maintenance, livestock grazing, wildfire suppression, wildland fuel management, recreation, and big-game management. Future timber sales and associated fuel treatments and non-commercial vegetation management in the vicinity include the Mineral Timber Sale scheduled for sale in 2004, the Jimmy Timber Sale scheduled for 2004, the Strike Timber Sale scheduled for 2004, and the Lead-Deadwood Exemption Area Wildland Urban-Interface (WUI) Project. These sales and projects would have units in watersheds adjacent to the cumulative effects area.

Effects

Historically, wildfire was a keystone ecological process that shaped the composition and structure of plant communities in the Black Hills. Over the past 100 years fire has been suppressed. Forest density has changed markedly in many Black Hills landscapes as a result of fire suppression. In the past, periodic surface fire consumed small seedlings, pruned lower branches, and consumed concentrations of woody fuels on the forest floor. If, or when large crown fires did occur, they probably did not completely consume all trees within a landscape, but left some sources of seed for the eventual reforestation of the burned area. The result was a mosaic of conditions ranging from openings to groups

of young seedlings to clumps and groups of older trees, including large orange-barked patriarchs (Sheppard and Battaglia 2002).

Forest vegetation has been altered since settlement in the 1870's through timber harvest, fire suppression, wildfire, mining, and grazing by livestock. The age-classes of ponderosa pine stands in the project area show that approximately 63% of the stands originated between 1880 and 1919. This was likely the result of a combination of wildfire, mountain pine beetle, and logging. Timber harvest, mountain pine beetle, and wildfire suppression over the last 125 years are responsible for the structure, composition, and appearance of the existing forest. The project area is dominated by relatively dense ponderosa pine stands, with smaller areas of quaking aspen and birch. Timber harvest has repeatedly thinned pine stands, however tree growth has exceeded harvest. Regeneration harvest treatments, shelterwood seedcut and clearcut, have taken place on less than 8% of pine stands since 1980, leaving a preponderance of similar age-class pine. Hardwoods are common in the understory of pine stands on north aspects. In general, more of the area is now forested with ponderosa pine, and less is forested with aspen and birch, there is less grassland, and the ponderosa pine is smaller. Browsing of hardwood sprouts by cattle and big game has contributed to a decrease in the presence of hardwoods, although information on the long-term effects of cattle grazing on regenerating aspen is lacking (Rumble, et al, 1996).

Firewood cutting in this area is common due to the close proximity to local communities. Due to logging residue and storm damage there has been an ample supply of firewood. Firewood cutting is now restricted to dead and down timber. Due to these factors, firewood cutting has had a minimal effect on existing snags.

Mining for gravel removed forest vegetation from several sites, which total approximately 10 acres. The windy-flats gravel pit has been abandoned and trees are taking over the site. The Virkula gravel pit is still active, however once gravel operations are completed, trees will take over the site. There should be no long-term effects on forest vegetation due to gravel pits.

The construction and maintenance of roads, recreation trails, and utility lines across the area has decreased the forested area. Maintenance crews routinely cut down trees growing up in utility and road corridors. These sites will not produce large trees or harvest volume as long as the corridors are maintained. The forest area in these corridors is very small and once abandoned, trees will seed-in and once again occupy the site so there should be no long-term effects on forest vegetation due to road, trail, and utility corridors.

Recreational activities have little or no effect on forest vegetation, other than the road and trail corridors previously discussed.

The development of private lands adjacent to forest stands have no direct effects on forest stands other than those associated with utility corridors. These lands will likely be managed to minimize wildfire risk. Stands with low-wildfire risk would be more characteristic of stands prior to settlement, when periodic low-intensity surface fire consumed wildland fuels. There should be no effects on forest vegetation that are outside of historic conditions.

Alternative 1

In the absence of treatment or wildfire, stands throughout the area would follow the successional trend toward increased composition of ponderosa pine, except in areas of moderate to high mountain pine beetle caused mortality. The area in hardwood cover type and hardwood inclusions would decrease as ponderosa pines seed-in and grow. Browsing of hardwoods would contribute to the decline of hardwoods in the area. Openings in the pine forest due to weather events and insect caused mortality would maintain some hardwoods, however ponderosa pine would be likely to occupy these sites as a seed source for pine would be nearby.

Mortality due to mountain pine beetle would be difficult to predict, although as stand density increases across the project area, risk of mountain pine beetle caused losses would increase. Mortality would range from scattered individual trees, to patches of mortality several hundred acres in size. Large populations of mountain pine beetle are present and suitable beetle habitat exists in the project area and vicinity (Allen et al. 2002). Large areas of intense beetle caused mortality could occur, similar to areas in Forbes Gulch where intense mortality approaches 1,000 acres or more. Extensive low to moderate levels of beetle caused mortality is also likely.

Past and on-going management actions that have changed the mix of age-classes, decreased stand stocking, and improved species diversity would have some beetle caused mortality, however beetle caused mortality should not be as intense or extensive as in areas with no recent management activity. Recent activity includes timber sales within the last 10-20 years and activities due to Public Law 107-206.

The amount of Forest land within road, recreation trail, and utility line corridors would remain unchanged with Alternative 1.

Alternative 2, 3, and 4

Alternatives 2, 3, and 4 would decrease the density of pine stands across a portion of the area, removing smaller diameter pines, and would create a more open forest of large diameter trees. The remaining pine trees would continue to grow in height and diameter. Hardwoods would increase in the treated areas, and hardwood stands with overstory trees in decline would be more likely to successfully regenerate.

Risk of mountain pine beetle caused losses would decrease within the project area with all action alternatives, although stands would increase in susceptibility to attack with growth and no further treatment. In most cases, thinned stands would change from moderate risk to high risk within 10-20 years. Stands within the project area contain suitable habitat for mountain pine beetles. A mountain pine beetle epidemic could build in this habitat and spread to stands throughout the project area.

Management actions in Alternatives 2, 3, and 4 would change the mix of age-classes, density, species diversity, and remove a portion of the beetle population. These actions should decrease mortality in treated stands. More stands stocked with moderate densities of mid-age to mature pine would remain on the landscape, as compared to Alternative 1, should the beetle outbreak continue.

Management actions in Alternatives 2, 3, 4, and actions authorized by Public Law 107-206 are in proximity to private lands. Treatments reducing beetle populations and decreasing risk of infestation should decrease the spread of mountain pine beetles from public to private land.

Forestland within road, recreation trail, and utility corridors would decrease with Alternatives 2, 3, and 4 due to the overall reduction of roads within the project area. There would be a slight increase in the amount of productive forestland with all action alternatives. Alternative 3 would do the most to return lands to forest production followed by Alternatives 2 and 4.

Cumulative Effects of Public Law 107-206 Activities Outside the Project Boundary

The cumulative effects area outside the project boundary includes 45,642 acres of National Forest land and 6,124 acres of other ownership. This area includes the Beaver Park Roadless Area and Surrounding Area described in Civil Action No. 99-N-2173 Settlement Agreement, Exhibit A2, and an additional five 7th order watersheds, which encompass activities undertaken due to Public Law 107-206.

Past actions to be analyzed for cumulative effects include those since settlement in the late 1800s. Reasonably foreseeable actions include those currently planned or actions that could be expected to happen within the next 20 years.

Past Actions

Past actions in the project area include timber harvest, silvicultural treatments, wildland fuel management, fire suppression, grazing, mining, gravel production, recreation, firewood cutting, big-game management, road construction, railroad construction, subdivision of private lands and home construction, utility line construction and maintenance.

Field reconnaissance shows timber harvest has occurred throughout the cumulative effects area since settlement in the late 1800s, however there are no records available for treatment prior to the 1980s. Harvest included green sawtimber trees and dead standing "pitch pine" which was used for fence posts. National Forest timber sales since 1982, within the project area are listed in the following table. Salvage sales in the early 1980s harvested timber damaged during a snowstorm that occurred Columbus Day weekend, 1982.

Table 17 Recent Timber Sales within Elk Bugs and Fuels Cumulative Effects Area and Outside the Project Area

Sale Name	Years of Harvest Activity	Sale Name	Years of Harvest Activity

Sale Name	Years of Harvest Activity	Sale Name	Years of Harvest Activity
Benchmark	1979-1986	Hay	1989-1991
Stagebarn	1981-1989	Lucky	1989-1993
Airport Salvage	1982	Novak	1991-1993
Greenwood	1982	Pit Resale	1991-1992
LS Salvage	1984	Greenmont	1991
Wilson Salvage	1984	Cave	1992
Erskine	1985	Flagstaff	1992-1993
Lucky East Bugs	1985	Dump	1993
Lucky West Bugs	1985	Greenwood	1996
Dalton	1986-1993	Bench	1997
Kelly	1986-1990	Kine	1997-1998
Skislide	1988-1991	Kirk	1998-present
Wilson	1988	Cavern	1999-present
Misty	1989-1990	Public Law 107-206 Sales	2002-present

Table 74 lists the acres of vegetation treated in National Forest timber sales in the 1980s, 1990s, 2000s, recently planned timber sales, and treatments planned and implemented under recent legislation, P.L. 107-206.

Table 18 Past and Planned Silviculture Treatments (RMRIS Data)

Treatment Code	Treatment Description	1980s	1990s	2000s	Planned
4111	Clearcut	117	109	0	259
4121	Shelterwood preparation	0	13	0	0
4131	Shelterwood seedcut	743	1843	0	26
4141-4143	Shelterwood removal and overstory removal	233	765	252	805
4152	Uneven-aged management – group selection	0	0	0	128
4220	Thin	9,265	4,500	78	5,481
4230	Salvage	1,261	0	0	0
4511/4521	TSI – Precommercial thinning	3,903	4,356	506	0
6104	Habitat improvement – tree encroachment control	0	41	0	217
6108	Regenerate aspen – clearcut	39	157	0	148
6109	Tree encroachment control	0	31	91	0
	Forbes Gulch Fuel Treatments				700

Treatment Code	Treatment Description	1980s	1990s	2000s	Planned
	Beaver Park – Forest Boundary Fuel Break				117
	Total Acres Treated by Decade (% of Forested Area)	15,561 (35%)	11,815 (26%)	927 (2%)	7,881 (18%)

Current Actions

Timber sales are currently under way on National Forest lands within the cumulative effects area and outside the project area; including Kirk, Cavern, and sales associated with Public Law 107-206. Livestock grazing occurs on National Forest and private land. Wildfires are suppressed. Subdivision and development of private land is taking place. Maintenance of roads, trails, and electric utility lines continues. Recreational activities include sightseeing, biking, use of all-terrain vehicles, and hunting. The State of South Dakota manages big game populations through regulated hunting.

Future Actions

Reasonable foreseeable future actions include continued development of private land, vegetation management on Federal and private lands, road and utility corridor maintenance, livestock grazing, wildfire suppression, wildland fuel management, recreation, and big-game management. Future timber sales and associated fuel treatments and non-commercial vegetation management in the vicinity include the Jimmy Timber Sale, and the Strike Timber Sale, both scheduled for 2004. These sales would have units in watersheds adjacent to the cumulative effects area.

Effects

Historically, wildfire was a keystone ecological process that shaped the composition and structure of plant communities in the Black Hills. Over the past 100 years fire has been suppressed. Forest density has changed markedly in many Black Hills landscapes as a result of fire suppression. In the past, periodic surface fire consumed small seedlings, pruned lower branches, and consumed concentrations of woody fuels on the forest floor. If, or when large crown fires did occur, they probably did not completely consume all trees within a landscape, but left some sources of seed for the eventual reforestation of the burned area. The result was a mosaic of conditions ranging from openings to groups of young seedlings to clumps and groups of older trees, including large orange-barked patriarchs (Sheppard and Battaglia 2002).

Forest vegetation has been altered since settlement in the 1870's through timber harvest, fire suppression, wildfire, mining, and grazing by livestock. The age-classes of ponderosa pine stands in this area are similar to the project area with most stands originating between 1880 and 1919. This was likely the result of a combination of wildfire, mountain pine beetle, and logging. Timber harvest, mountain pine beetle, and wildfire suppression over the last 125 years are responsible for the structure, composition, and appearance of the existing forest. The cumulative effects area is dominated by relatively dense ponderosa pine stands, with smaller areas of quaking aspen and birch. Timber harvest has repeatedly thinned pine stands, however tree growth has exceeded harvest. Regeneration harvest treatments, shelterwood seedcut and clearcut, have taken place on less than 7% of pine stands, leaving a preponderance of similar age-class pine. Hardwoods are common in the understory of pine stands on north aspects. In general, more of the area is now forested with ponderosa pine, and less is forested with aspen and birch, there is less grassland, and the ponderosa pine is smaller. Browsing of hardwood sprouts by cattle and big game has likely decreased the presence of hardwoods, although information on the long-term effects of cattle grazing on regenerating aspen is lacking (Rumble, et al, 1996).

Firewood cutting in this area is common due to the close proximity to local communities. Due to logging residue and storm damage, there has been an ample supply of firewood. Firewood cutting is now restricted to dead and down timber. Due to these factors, firewood cutting has minimal effect on existing snags.

The construction and maintenance of roads, recreation trails, and utility lines across the area has decreased the forested area. Maintenance crews routinely cut down trees growing up in utility and road corridors. These sites will not produce large trees or harvest volume as long as the corridors are maintained. The forest area in these corridors is very small and once abandoned, trees seed-in and occupy the site so there should be no long-term effects on forest vegetation due to road, trail, and utility corridors.

Recreational activities have little or no effect on forest vegetation, other than the road and trail corridors previously discussed.

The development of private lands adjacent to forest stands have no direct effects on forest stands other than those associated with servicing utility corridors, however these lands will likely be managed to minimize wildfire risk. Stands with low-wildfire risk would be more characteristic of stands prior to settlement, when periodic low-intensity surface fire consumed wild land fuels. There should be no effects on forest vegetation outside of historic conditions.

Treatments in recent planned timber sales: Kirk, Cavern, Public Law 107-206 sales, and fuel treatments will decrease stocking across approximately 15% of the ponderosa pine cover-type. Treatments that regenerate aspen and pine will occur on less than 1% of the area. Mountain pine beetle sanitation will also occur in these projects. These treatments, and past treatments, which decrease stocking, improve diversity in age-class, decrease stand susceptibility to beetle caused mortality, and decrease beetle populations should decrease the effects of a mountain pine beetle outbreak. More stands stocked with moderate densities of mid-age to mature pine are likely to remain on the landscape, should the beetle outbreak continue.

Table 75 displays the mountain pine beetle risk rating of ponderosa pine stands within the cumulative effects area. Risk was calculated by the RMSTAND program for stands with tree data. Recently treated stands and stands planned for treatment were rated based on estimated post-treatment stand structure, average tree diameter, and stand density, following guidelines from the Rocky Mountain Forest and Range Experiment Station (Stevens, et al. 1980).

Table 19 Ponderosa Pine Stands: Mountain Pine Beetle Risk

Risk Rating	Risk – Acres (% of PP Covertype)
	Alt. 1
No Rating	434 (1%)
Low	19,745 (45%)
Moderate	15,156 (35%)
High	8,346 (19%)

Snags and Green Tree Retention

Alternative 1 would have no effect on existing snags and would leave all existing live trees as potential future snags. Mountain pine beetles, other insects, and disease caused mortality; weather events, and tree-to-tree competition would continue to create snags.

The Revised Forest Plan requires retention of sufficient large green trees to provide future large-diameter snags (standard 2302, guideline 2306). Alternatives 2, 3 and 4 would move hard snag densities toward Forest Plan standards. At least 3 live pine trees per acre over 20" in diameter (averaged across the watershed) should exist on north and east aspects, and 1.75 per acre on other slopes. These numbers would allow for large snag recruitment while maintaining minimum densities for large green trees (USDA Forest Service 2001). Other diameter classes are represented across the watershed to provide other sizes of snags and to provide trees that will grow to be over 20" in the future.

Using the Forest Vegetation Simulator, the number of live trees in each 2" diameter class from 10" to 20" DBH and 20"+ DBH in the ponderosa pine cover-type were estimated for each aspect and watershed for years 2003 and 2023 (USDA Forest Service 2001).

Table 20 Post Treatment Green Tree Retention on Pine Sites by Aspect and Watershed

7th Order Watershed	Year and Alt.	Aspect	Live Pine Per Acre by 2" Diameter Class					
			10-12"	12-14"	14-16"	16-18"	18-20"	>20"
10120202060202	2003	North	9	15	23	15	4	2
		South	25	25	24	13	12	3
	Alt. 1: 2023	North	4	5	19	21	10	2
		South	5	2	3	5	8	9

7th Order Watershed	Year and Alt.	Aspect	Live Pine Per Acre by 2" Diameter Class					
			10-12"	12-14"	14-16"	16-18"	18-20"	>20"
	Alt. 2: 2023	North	4	5	19	21	10	2
		South	5	2	3	5	8	9
	Alt. 3: 2023	North	4	5	19	21	10	2
		South	5	2	3	5	8	9
	Alt. 4: 2023	North	4	5	19	21	9	2
		South	5	2	3	5	8	9
10120202020105	2003	North	24	14	8	4	0	1
		South	20	19	13	8	0	1
	Alt. 1: 2023	North	25	14	11	5	0	2
		South	20	15	14	12	0	3
	Alt. 2: 2023	North	23	14	10	5	0	2
		South	18	14	13	11	0	3
	Alt. 3: 2023	North	23	13	11	7	0	2
		South	17	12	12	11	0	3
	Alt. 4: 2023	North	23	14	10	5	0	2
		South	18	14	13	11	0	3
10120202060105	2003	North	21	17	8	3	2	1
		South	25	30	14	5	2	1
	Alt. 1: 2023	North	21	15	17	6	2	2
		South	29	24	20	8	3	1
	Alt. 2: 2023	North	15	13	17	6	2	2
		South	28	25	20	8	3	1
	Alt. 3: 2023	North	21	14	17	6	2	2
		South	27	21	19	8	4	1
	Alt. 4: 2023	North	15	13	17	6	2	2
		South	28	23	20	8	3	1
10120202060106	2003	North	36	21	10	5	2	1
		South	37	22	10	5	2	1
	Alt. 1: 2023	North	29	21	13	12	3	2
		South	34	22	14	9	4	2
	Alt. 2: 2023	North	28	21	13	12	3	2
		South	31	22	14	9	4	2
	Alt. 3: 2023	North	29	21	13	12	3	2
		South	28	21	14	8	4	2
	Alt. 4: 2023	North	28	21	13	12	3	2
		South	31	22	14	9	4	2
10120202060104	2003	North	25	25	12	7	4	2
		South	27	22	12	6	3	3
	Alt. 1: 2023	North	27	26	15	10	7	3
		South	36	24	16	9	5	5
		North	25	24	14	9	7	3

7th Order	Year and Alt.	Aspect	Live Pine Per Acre by 2" Diameter Class					
			10-12"	12-14"	14-16"	16-18"	18-20"	>20"
	Alt. 2: 2023	South	32	22	14	8	4	5
	Alt. 3: 2023	North	26	25	25	10	7	3
		South	31	23	15	8	4	5
	Alt. 4: 2023	North	25	24	14	9	7	3
		South	32	22	14	8	4	5
10120202060103	2003	North	25	18	8	4	3	2
		South	23	21	7	4	2	1
	Alt. 1: 2023	North	25	21	12	6	3	3
		South	31	22	13	5	3	2
	Alt. 2: 2023	North	24	21	12	6	3	3
		South	31	22	13	5	3	2
	Alt. 3: 2023	North	24	21	12	6	3	3
		South	22	20	12	5	3	2
	Alt. 4: 2023	North	24	21	12	6	3	3
		South	31	22	13	5	3	2
10120202070101	2003	North	45	25	12	6	2	2
		South	39	25	11	11	6	3
	Alt. 1: 2023	North	42	31	17	8	4	2
		South	35	24	17	12	8	5
	Alt. 2: 2023	North	42	31	17	8	4	2
		South	35	24	17	12	8	5
	Alt. 3: 2023	North	42	31	17	8	4	2
		South	35	24	17	12	8	5
	Alt. 4: 2023	North	42	31	17	8	4	2
		South	35	24	17	12	8	5
10120111020301	2003	North	48	25	12	6	2	1
		South	51	27	16	6	3	2
	Alt. 1: 2023	North	56	30	17	9	3	2
		South	41	25	17	10	4	3
	Alt. 2: 2023	North	56	30	17	9	3	2
		South	41	25	17	10	4	3
	Alt. 3: 2023	North	56	30	17	9	3	2
		South	41	25	17	10	4	3
	Alt. 4: 2023	North	56	30	17	9	3	2
		South	41	25	17	10	4	3
10120202060102	2003	North	28	17	10	5	3	1
		South	34	21	9	5	3	1
	Alt. 1: 2023	North	19	26	13	8	3	3
		South	33	25	14	7	4	2
	Alt. 2: 2023	North	19	16	12	7	3	3
		South	29	22	13	7	4	2
		North	19	16	13	8	3	3

7th Order Watershed	Year and Alt.	Aspect	Live Pine Per Acre by 2" Diameter Class					
			10-12"	12-14"	14-16"	16-18"	18-20"	>20"
	Alt. 3: 2023	South	27	21	14	7	4	2
	Alt. 4: 2023	North	19	16	12	7	3	3
		South	29	22	13	7	4	2
10120111020103	2003	North	27	15	7	3	2	1
		South	33	18	8	4	2	0
	Alt. 1: 2023	North	22	14	10	4	2	2
		South	24	18	11	6	3	1
	Alt. 2: 2023	North	21	13	10	4	2	2
		South	22	17	11	6	3	1
	Alt. 3: 2023	North	21	13	10	4	2	2
		South	19	17	11	7	3	1
	Alt. 4: 2023	North	21	13	10	4	2	2
		South	22	17	11	6	3	1
10120111020305	2003	North	33	18	9	4	2	1
		South	40	18	10	5	3	2
	Alt. 1: 2023	North	33	23	13	7	3	2
		South	41	26	15	7	4	3
	Alt. 2: 2023	North	31	22	13	6	3	2
		South	41	26	15	7	4	3
	Alt. 3: 2023	North	32	23	13	7	3	2
		South	41	26	15	7	4	3
	Alt. 4: 2023	North	31	22	13	6	3	2
		South	41	26	15	7	4	3
10120111020102	2003	North	17	19	10	5	3	1
		South	15	13	8	6	2	1
	Alt. 1: 2023	North	15	18	12	8	5	3
		South	15	12	11	7	5	3
	Alt. 2: 2023	North	9	12	10	7	5	3
		South	9	7	8	5	5	3
	Alt. 3: 2023	North	14	18	12	8	5	3
		South	10	10	10	6	5	3
	Alt. 4: 2023	North	9	12	10	7	5	3
		South	9	7	8	6	5	3
10120111020104	2003	North	19	11	5	2	1	1
		South	28	14	10	4	3	2
	Alt. 1: 2023	North	33	15	7	4	1	1
		South	37	18	12	4	4	3
	Alt. 2: 2023	North	33	15	7	4	1	1
		South	33	16	11	4	3	3
		North	33	15	7	4	2	1

7th Order Watershed	Year and Alt.	Aspect	Live Pine Per Acre by 2" Diameter Class					
			10-12"	12-14"	14-16"	16-18"	18-20"	>20"
	Alt. 3: 2023	South	34	17	12	4	3	3
	Alt. 4: 2023	North	33	15	7	4	1	1
		South	33	16	11	4	3	3
10120111020105	2003	North	22	13	6	3	2	1
		South	21	10	4	2	2	2
	2023	North	31	18	9	4	2	2
		South	29	14	7	2	2	2
10120111010103	2003	North	21	15	7	4	2	2
		South	20	15	9	4	2	2
	2023	North	27	17	11	5	3	3
		South	24	16	12	6	3	3
10120111020201	2003	North	31	16	6	2	1	0
		South	31	16	5	3	1	0
	2023	North	30	22	10	4	1	1
		South	32	20	11	4	2	0
10120111010204	2003	North	34	16	7	3	1	0
		South	35	24	11	3	2	0
	2023	North	53	20	10	5	2	1
		South	37	24	18	6	3	1
10120111010301	2003	North	26	12	6	2	1	0
		South	21	13	6	4	1	1
	2023	North	34	17	9	4	1	1
		South	35	14	9	5	3	1

Alternatives 2, 3, and 4 would slightly decrease existing snag populations as some snags would need to be cut during harvest operations for safety reasons, however most snags would remain standing. Mountain pine beetles, other insects, disease caused mortality, weather events, and tree-to-tree competition would create snags. Due to thinning and reduced tree-to-tree competition, future mortality in the lower diameter classes should be less than Alternative 1, however growth of the remaining trees should provide green trees of larger diameter for future snag recruitment. Thinning and fuel treatments planned in these alternatives will retain the largest trees on site, and improve the growth of the remaining trees. Alternatives 2, 3, and 4 would slightly increase the number of large green trees in the future.

Wildlife Habitat

Affected Environment:

All acre summaries and habitat discussions are based on Forest Service land only, unless otherwise noted.

Existing Condition

The project area is characterized by vegetation cover type. Approximately 93% of the National Forest System land is in ponderosa pine, with 4.5% in hardwoods, 0.7% in spruce, and 1.5% in dry or riparian meadows, and 0.2% in nonvegetated areas. Dominance of ponderosa pine is a natural condition in the Black Hills, but pine is probably more dominant now than it was historically. Although other plant communities are in limited supply, they provide vital habitat components for many wildlife species.

Existing forest structure is generally dominated by stands of mature pine at various densities (Table 77). Pure stands of young trees are unusual. Many of the open stands have an understory of pine seedlings and saplings. Forest structural stage (SS) is described as follows:

SS 1: Grasses and forbs

SS 2: Seedlings and saplings

SS 3A: Young, open forest

SS 3B: Young, moderately dense forest

SS 3C: Young, dense forest

SS 4A: Mature, open forest

SS 4B: Mature, moderately dense forest

SS 4C: Mature, dense forest

SS 5: Late succession ("old growth")

Refer to the forest vegetation resource description in this chapter for additional information on the existing forest structure.

Environmental Consequences

Table 78, Table 79 and Table 80 show post-treatment structural stage by cover type for each action alternative.

Table 21 Existing (Alternative 1) structural stage distribution by cover type

Habitat	SS 1	SS 2	SS 3A	SS 3B	SS 3C	SS 4A	SS 4B	SS 4C	SS 5	Total
Meadow	635.3	0	0	0	0	21.4	0	0	0	*656.7*

Aspen	272.9	366.4	81.9	167.1	25.1	273.8	400.3	61.3	0	*1648.8*
Birch	15.4	39.2	80.9	54.4	95.6	0	25.1	0	0	*310.6*
Bur oak	0	11.2	0	0	0	0	0	34.4	0	*45.6*
Pine	474.1	1224.4	1975.1	2237.4	3573.0	10183.2	12237.3	9670.1	47.1	*41621.7*
Spruce	0	0	7.9	0	0	235.5	53.3	15.7	0	*312.4*
Total	*1397.7*	*1641.2*	*2145.8*	*2458.9*	*3694*	*10714*	*12716*	*9781.5*	*47.1*	*44595.8*

Table 22 Alternative 2 structural stage distributions by cover type

	SS 1	SS 2	SS 3A	SS 3B	SS 3C	SS 4A	SS 4B	SS 4C	SS 5	Total
Meadow	635.3	0	0	0	0	21.4	0	0	0	*656.7*
Aspen	206.3	239.5	187.2	290.2	25.1	290.7	348.5	61.3	0	*1648.8*
Birch	15.4	39.2	82.6	52.7	95.6	18.5	6.6	0	0	*310.6*
Bur oak	0	11.2	0	0	0	0	0	34.4	0	*45.6*
Pine	414.1	1186.9	3247.4	2030.7	2523	13073.5	9675.9	9423.1	47.1	*41621.7*
Spruce	0	0	7.9	0	0	235.5	53.3	15.7	0	*312.4*
Totals	*1271.1*	*1476.8*	*3525.1*	*2373.6*	*2644*	*13640*	*10084*	*9534.5*	*47.1*	*44595.8*

Table 23 Alternative 3 structural stage distributions by cover type

Habitat	SS 1	SS 2	SS 3A	SS 3B	SS 3C	SS 4A	SS 4B	SS 4C	SS 5	Total
Meadow	635.3	0	0	0	0	21.4	0	0	0	*656.7*
Aspen	206.3	239.5	187.2	290.2	25.1	290.7	348.5	61.3	0	*1648.8*
Birch	15.4	39.2	14	149.5	54.5	12.9	25.1	0	0	*310.6*
Bur oak	0	11.2	0	0	0	0	0	34.4	0	*45.6*
Pine	440.4	1214.1	2303.4	2958.5	2514.1	13251.9	9522.9	9369.6	47.1	*41622.0*
Spruce	0	0	7.9	0	0	235.5	53.3	15.7	0	*312.4*
Totals	*1297.4*	*1504*	*2512.5*	*3398.2*	*2594*	*13812*	*9949.8*	*9481*	*47.1*	*44596.1*

Table 24 Alternative 4 structural stage distributions by cover type

Habitat	SS 1	SS 2	SS 3A	SS 3B	SS 3C	SS 4A	SS 4B	SS 4C	SS 5	Total
Meadow	635.3	0	0	0	0	21.4	0	0	0	*656.7*
Aspen	206.3	239.5	187.2	290.2	25.1	290.7	348.5	61.3	0	*1648.8*
Birch	15.4	39.2	82.6	52.7	95.6	18.5	6.6	0	0	*310.6*
Bur oak	0	11.2	0	0	0	0	0	34.4	0	*45.6*
Pine	414.1	1186.9	3488.9	1931.5	2380.5	13248.1	9501.5	9423.1	47.1	*41621.7*
Spruce	0	0	7.9	0	0	235.5	53.3	15.7	0	*312.4*

Totals	*1271.1*	*1476.8*	*3766.6*	*2274.4*	*2501*	*13814*	*9909.9*	*9534.5*	*47.1*	*44595.8*

Direct, Indirect, and Cumulative Effects

Effects on Meadows and Open Habitat

Structural stage 1 in the Grass cover type consists of grasses and forbs. Meadows are shown in Tables 77 through 80 as separate from forest structural stage 1, since the two designations are not synonymous. Meadows are natural openings and usually exist on soils formed under grass. Structural stage 1 under the various timber types is the first step in forest succession and occurs in forest openings such as clearcuts or patches of timber killed by mountain pine beetles. Meadows generally produce more forage than the grass/forb timber stage and often contain different plant composition.

Encroaching conifer removal was conducted under previous vegetation management projects within portions of the planning area. This project proposes to remove encroaching pine on 258 acres of meadow habitat under alternative 3, and prescribe burn 59 acres, with combined treatments on many acres. These treatments would maintain meadow habitat in the treated stands, restore plant vigor, and may slightly increase total meadow area.

Effects on Hardwood Habitat

Aspen and birch are important components of Black Hills habitat diversity. Deer and elk browse both species, while ruffed grouse, red-naped sapsuckers, and various songbirds use hardwood habitat for feeding and nesting. Young aspen stands are also very important deer fawning habitat (Kennedy 1992).

Conifers are encroaching many of the hardwood sites. Left untreated, these conifers will eventually overtake the hardwoods. Alternative 1 would result in an eventual decrease of hardwood acres.

The action alternatives include hardwood maintenance treatments consisting of pine removal, stand regeneration, or a combination of both. No alternative would remove all acres of any hardwood habitat structural stage. Prescribed fire will be applied to several hardwood stands to stimulate understory response of aspen. Some mortality of overstory trees will occur, creating snags and diversity with stands.

Effects on Open Mature Pine Habitat

Open mature pine stands (structural stage 4A) currently comprise 24% of the ponderosa pine cover type. While the average diameters are relatively small (9-13 inches) these stands still represent potential suitable habitat for several species, including pygmy nuthatch, Lewis' woodpecker, deer, elk, and several raptors.

All action alternatives would increase acreage of open mature ponderosa pine. Alternative 2 increases the portion of open mature stands to 31% of pine acres, and alternatives 3 and 4 increase open pine stands to 32%. As stands are thinned, diameter, tree height, and crown growth will accelerate, thereby moving these stands toward conditions more suitable for species requiring large-diameter open-grown ponderosa pine.

Underburning would be applied primarily in this habitat type, and would be low intensity to consume finer fuels and emulate historic fire behavior in open pine stands. The grass/forb understory component is expected to respond positively to burn treatments.

Effects on Moderate and High Density Pine Habitat and Late Succession

Dense mature pine stands (structural stages 4B and 4C) currently comprise 53% of the ponderosa pine type. Alternative 1 would retain all dense stands. However, many of these stands will be less dense after the current mountain pine beetle epidemic has run its course. Alternative 2 would decrease dense stand acreage to 46% of ponderosa pine acreage, while alternatives 3 and 4 would decrease dense stands to 45%.

Effects on White Spruce Habitat

Approximately 312 acres of white spruce habitat are located in the project area. No treatment within these stands is proposed under any alternative.

Effects on Snag Habitat

Snags (dead standing trees) are an important habitat component for many species. Primary cavity nesters such as the black-backed woodpecker excavate their own cavities in dead trees that have rotting heartwood. Secondary cavity nesters such as the white-breasted nuthatch use natural cavities or abandoned woodpecker cavities.

Table 81 displays the existing average number of ponderosa pine snags by aspect, 10 inches in diameter or greater, in stands of ponderosa pine cover-type throughout the thirteen 7th order watersheds associated with the project area. Information regarding snag height is not available, and live trees with snag characteristics are not included. Several watersheds fail to meet Forest Plan standards for existing snags. The ongoing mountain pine beetle epidemic within Elk Bugs and Fuel is expected to create numerous additional snags across the landscape in 4B and 4C stands under all alternatives.

Table 25 Existing Pine Snags, 10” DBH and Larger (RMRIS Tree Data)

Watershed (Watershed ID)	Aspect	Snags/Acre
10120202060202	North	1.0

Watershed (Watershed ID)	Aspect	Snags/Acre
	South	1.83
10120202020105	North	3.36
	South	3.29
10120202060105	North	0.60
	South	1.18
10120202060106	North	2.27
	South	4.29
10120202060104	North	2.74
	South	2.39
10120202060103	North	3.01
	South	2.97
10120202070101	North	6.04
	South	5.21
10120111020301	North	2.87
	South	2.52
10120202060102	North	4.95
	South	3.06
10120111020103	North	1.78
	South	2.32
10120111020305	North	2.42
	South	2.06
10120202060202	North	1.08
	South	0.77
10120111020104	North	1.27
	South	1.66

Alternative 1

Alternative 1 would have no effect on existing snags and would leave all existing live trees in place as potential future snag habitat. It would have no immediate effect on dense stands, which are potential habitat for sensitive species such as northern three-toed woodpecker and black-backed woodpecker. Alternative 1 would result in short-term habitat increases for these species, as retention and continued development or stagnation of dense stands would increase risk of insect infestation.

Snags in open-canopy stands are habitat for species such as Lewis' woodpecker and northern flicker. This habitat could diminish over time as open stands regenerate and become denser.

Snag recruitment rates are likely to be greatest under alternative 1 in the short-term since beetle-induced mortality is more likely in dense stands. Large trees, which are likely to be killed by mountain pine beetle during the current epidemic, will be fewer in the long-term under this alternative leading to fewer large snags in the long-term.

Alternatives 2, 3, and 4

Under the action alternatives, snags that pose a safety hazard during logging operations would be cut and retained on site, where they would add to the down woody component. All other existing snags would be left standing (see Appendix B, Mitigation).

All action alternatives would thin a portion of the project area's dense stands. Thinning would decrease short-term snag recruitment within treated stands since the residual trees would be less likely to succumb to insects, diseases, or natural mortality. Conversely, trees in thinned stands are expected to live longer and under better growing conditions, resulting in larger-diameter snags for the future. Thinning under this project is designed to retain the largest trees and remove smaller trees competing for resources, whereas mountain pine beetle will kill some large diameter trees.

Table 82 shows the residual mountain pine beetle risk level under individual alternatives for ponderosa pine stands. Using mountain pine beetle risk as an indicator of potential snag development from insect attack, the action alternatives would reduce the percentage of high-risk ponderosa pine stands from an existing 21% to a range of 18-19%. Stands at moderate risk would stay relatively constant under each alternative. When combining moderate and high risk categories, the action alternatives maintain between 58% and 59% of pine acreage at elevated pine beetle risk where some level of mortality, and natural snag creation, is reasonably certain to occur.

Table 26 Post-Treatment Mountain Pine Beetle Risk

Risk Rating	Post-treatment Risk – Acres (% of PP Cover type)			
	Alt. 1	Alt 2	Alt. 3	Alt. 4
Low	16,464 (40%)	17,274 (42%)	16,692 (40%)	17,303 (42%)
Moderate	16,219 (40%)	16,683 (40%)	17,190 (41%)	16,677 (40%)
High	8,941 (21%)	7,667 (18%)	7,742 (19%)	7,644 (18%)

Effects on Green Tree Replacements

The Revised Forest Plan requires retention of sufficient large green trees to provide future large-diameter snags (standard 2302, guideline 2306). Using the Forest Vegetation Simulator, the number of live trees in each 2" diameter class from 10" to 20" DBH and 20"+ DBH in the ponderosa pine cover-type were estimated for each aspect and watershed for years 2003 and 2023. Alternative 2, 3 and 4 would move hard snag densities toward Forest Plan standards. At least 3 live pine trees per acre over 20" in diameter (averaged across the watershed) should exist on north and east aspects, and 1.75 per acre on other slopes. These numbers would allow for large snag recruitment while maintaining minimum densities for large green trees. Other diameter classes are represented across the watershed to provide other sizes of snags and to provide trees that will grow to be over 20" in the future (Project File, Section 2.2).

Effects on Down Woody Material

Availability of large down wood varies across the project area. Although large landing piles may be used for firewood, smaller piles and scattered logs remain to provide habitat for small mammals. Alternative 1 would have the greatest recruitment potential since all available trees could contribute to future recruitment. To ensure that proposed treatment areas are not lacking large, down woody material in the future, cull logs greater than 10" DBH would be left on site or returned to the site on all stands not requiring whole tree skidding. This mitigation would meet guideline 2307.

THREATENED, ENDANGERED, AND SENSITIVE WILDLIFE SPECIES

Bald eagles (Haliaeetus leucocephalus) are the only federally listed (threatened) species occurring in the project area. They are frequent winter migrants on the Northern Hills Ranger District. However, no nesting is known to occur within the Black Hills National Forest. No other threatened, endangered, or proposed species is known to occur within

the project areas nor does critical habitat exist. Habitat does not exist for black-footed ferret, black-tailed prairie dog, or mountain plover.

Species listed as Threatened, Endangered, and Proposed for Listing with potential to occur in Lawrence County, South Dakota are considered (Table 83). All sensitive species known to occur or potentially occurring on the Black Hills National Forest and nearby vicinity are considered (USDA 1994) and listed in Table 83. Species marked as "present" or "habitat present" are considered further for effects analysis.

Table 27 Habitat and Expected Occurrence of TEPS species within the project area.

Species	*Status*	*Species Present*[1]	*Habitat Present*[2]	***Habitat Description***
Black-footed Ferret	E			Prairie dog towns (FWS WWW). No known occupied sites in the Black Hills.
Whooping Crane	E			Shallow wetlands and meadows; migratory in South Dakota (FWS WWW).
Mountain Plover	E			Short-grass prairie dominated by blue grama (FWS WWW).
Bald Eagle	T	X	X	Usually found near unfrozen water or carrion in winter (Tallman et al. 2002). No nests or traditional roosts known in project area.
Fringed-tailed Myotis	S		X	Forages on insects in a variety of habitats including grasslands and forested areas. Roosts in a variety of structures including caves, mines, tunnels, and buildings (Schmidt 2003a).
Townsend's Big-eared Bat	S		X	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 2003b).
Black-tailed Prairie Dog	S			Short-grass and mixed-grass prairies (FWS WWW).
American Marten	S		X	Spruce forests with complex near-ground structure, extending into adjacent ponderosa pine stands. Dense pine for movement (Buskirk 2002).
Northern Goshawk	S	X	X	Forages in a variety of forested areas and small openings; Nests primarily in dense mature conifer forests (Erickson 1987).
Osprey	S			Lakes and large rivers with large populations of fish (Tallman et al. 2002).

Species	Status	Species Present[1]	Habitat Present[2]	Habitat Description
Merlin	S			Open pine forests and prairie edges (Tallman et al. 2002).
Peregrine Falcon	S			Open areas and woodland edges (Tallman et al. 2002).
Upland Sandpiper	S			Grasslands. Uncommon and local in Black Hills (Tallman et al. 2002).
Western Yellow-billed Cuckoo	S			Low elevation riparian areas and woodlands characterized with cottonwood-willow or burr oak (Panjabi 2003, FWS www)
Western Burrowing Owl	S			Dry grasslands and pastures, usually associated with prairie dogs or ground squirrels (Tallman et al. 2002).
Flammulated Owl	S		X	Open ponderosa pine forests (Hayward and Verner 1994).
Lewis' Woodpecker	S		X	Open burned areas with large snags; oak and cottonwood forests (Anderson 2003, Panjabi 2003)
Black-backed Woodpecker	S		X	Burned areas with a high density of pre-burn snags; Dense and/or mature forests with a high snag density (Anderson 2003, Panjabi 2003).
Northern Three-toed Woodpecker	S		X	Mature spruce forests, burned areas (Panjabi 2003).
Pygmy Nuthatch	S		X	Mature pine and spruce forests (Panjabi 2003, Tallman et al. 2002)
Golden-crowned Kinglet	S		X	Spruce forests, usually mature (Panjabi 2003).
Loggerhead Shrike	S			Open country with scattered, low deciduous thickets (Tallman et al. 2002).
Fox Sparrow	S			Shrubby woodlands, groves, and thickets (Tallman et al. 2002)
Tiger Salamander	S		X	Non- or slow-flowing water bodies for reproduction; upland habitats with logs, stones, or other cover for adults (Smith in press)
Northern Leopard Frog	S		X	Riparian and wetland areas for tadpoles, subadults, and breeding adults; upland habitats for foraging adults (Smith 2003).
Black Hills Redbelly Snake	S		X	Moist habitats with well-developed ground litter (Smith and Stephens 2003).

Species	*Status*	*Species Present*[1]	*Habitat Present*[2]	***Habitat Description***
Milk Snake	S		X	Diverse habitats including meadows, woodlands, and pine forests. (Behler and King 1979).
Cockerell's Striate Disc	S		X	Moist woodland sites with limestone substrate, often at the base of north-facing slopes or at the dry edge of riparian areas (Frest and Johannes 2002)
Cooper's Rocky Mountain Snail	S		X	Lowland wooded or riparian areas on limestone soils (Frest and Johannes 2002)
Regal Fritillary Butterfly	S			Tallgrass prairie and extensive grasslands with violets. (Royer and Marrone 1992)
Tawny Crescent Butterfly	S		X	Moist meadows and streams bottoms near forest openings (Marrone 2002).

Specie specific Findings and Analysis of Effects

Bald Eagle

Habitat summary: In the Black Hills, this species utilizes winter habitat where carrion is available (along highways and in big game winter range) and where there are open lakes and streams. It uses large diameter trees for hunting perches and roost trees.

Distribution/abundance: In the Black Hills, this species is a winter resident only (SDOU 1991). Bald Eagles have been documented in all counties in the Black Hills (District Files).

Threats: Threats are minimal. This species is a winter resident only in the Black Hills. There is no critical habitat designated in the Black Hills and no winter concentration areas are known. Use of chlorinated hydrocarbons is prohibited on the Black Hills National Forest (standard 3101 FP page II-43).

Direct/Indirect effects: Bald eagles are common winter migrants in the project area. They are not known to nest in the Black Hills either historically or in recent years. Quality habitat is lacking within the project area due to the absence of large fish-supporting streams. Small streams may support localized foraging, but not breeding populations of eagles. Eagles observed during the winter have been feeding on carrion including gut piles from harvested deer, road kills, and winterkills. Winter use of the project area is apparently random with no established winter concentration areas. Large

trees suitable for roosting exist along some riparian areas, but are marginal habitat at best. Open stands with large trees occur within the analysis area away from water. Some winter roost trees could be removed, but Phase I standard 2306 will ensure large diameter trees are maintained across the landscape.

Cumulative effects: Carrion supply is expected to remain relatively unchanged. Additional large trees could be removed by private land logging, but effects would be negligible. With chlorinated hydrocarbons prohibited on the Forest, chemical contamination risk is low.

Determination: Risk levels are low. There would be no effect on bald eagles under any alternative.

Northern Goshawk (Accipiter gentilis)

Habitat summary: Nesting habitat is most often dense mature ponderosa pine (4C/5) in the Black Hills although denser 4B is also used in some cases (Erickson 1987). Fledgling habitat consists of pine in structural stages 3B, 3C, 4B, 4C, and 5 (Reynolds 1992). Foraging habitat is more dependent upon prey species and includes a variety of habitat types and structural stages.

Distribution/abundance: Goshawks were considered winter residents in South Dakota in the early 1900s with only suspected breeding occurring within the state (Over and Thoms 1920,1946). They are known from all Black Hills Counties and are considered a rare to uncommon resident in the Black Hills (SDOU 1991, Peterson 1990).

Threats: Loss of dense habitat for nesting and fledgling due to logging or wildfire. Also is susceptible to human disturbance during nesting period. Low reproductive rate makes recovery slow.

Direct/Indirect effects:

Nesting habitat: Several historic and active territories are known to occur within the project. All known and historic nest sites were surveyed for goshawk presence during 2002. Since comprehensive surveys of suitable habitat were not surveyed, the Interdisciplinary Team decided to removal all potential goshawk nesting habitat from harvest consideration. Stands were assessed for suitability using definitions provided by Erickson (1987), and consisted of conifer stands in habitat structural stages 4B and 4C with canopy closures equal to or greater than 60%, with inclusion of trees greater than 13

inches DBH. In total, 12,794 acres (29% of the project area) were classified as suitable nesting habitat and were deleted from timber management consideration. No treatment that alters habitat structural stage would occur in the historic, alternate, or suitable nest stands under any alternative (Mitigation #4, Appendix A). No timing restrictions are required since no treatment is proposed within ¼ mile of active nest stands.

Post fledgling habitat (PFA): A total of 8 PFAs were designated within or immediately adjacent to the project area. Some are associated with known or historic nest sites, while others were designated in areas devoid of known or historic nests to provide potential future nesting and post fledging within empty territories. Since no treatments expected to alter stand habitat structure are proposed in the PFAs, all alternatives will maintain the current balance of structural stages.

Forage habitat: Existing foraging habitat is maintained under alternative 1 and is essentially maintained under the action alternatives since alternatives were designed to meet goshawk nesting requirements and habitat effectiveness standards for big game. Application of underburning and prescribed fire is expected to enhance forage habitat for goshawks.

Cumulative effects: Nest stands and their associated PFAs are being tracked in the District database for future planning efforts. There would be similar future trends for nesting, PFA, and foraging habitat under all alternatives since treatments do not alter existing nesting habitat or designated PFAs. Vegetation management activities that are ongoing or reasonably certain to occur were considered as already implemented on the landscape when PFAs were designated for this project.

Private land adjacent to PFAs could be logged or developed, although no plans are known at this time. While this could impact habitat in the immediate area, private land was not included in PFA designation or acre calculations. The greatest potential threat from private land logging or development would be disturbance during nesting season. The Forest Service has no jurisdiction over private land or authority to impose timing restrictions on private land activities.

Determination: Alternative 1 would have no impact. Alternatives 2, 3, and 4 may adversely impact individuals through disturbance or changes in forage habitat, but are not likely to result in a loss of viability, nor cause a trend to federal listing. This determination is made based on designation of the PFAs and retention of suitable nest stands. Actual use of these areas may vary.

Black-backed woodpecker (Picoides arcticus)

Habitat summary: Suitable habitat includes bug-killed or fire-killed conifer, and structural stages 4C, and 5 in undisturbed spruce and pine stands (Mohren 2002).

Distribution/abundance: In the Black Hills, this species is considered a rare permanent resident in higher elevations (SDOU 1991). This species' preference for burned forests in a time of fire suppression, its eruptive populations and lack of population information has identified it as a species of concern (Finch 1992).

Threats: This species requires dense habitat with large diameter snags. Salvage logging is detrimental to the species.

Direct/Indirect effects: Alternative 1 would maintain the current 23% of ponderosa pine stands in potential suitable habitat. The action alternatives would also retain potential habitat within 23% of pine acres. Acres remaining in 4C are at high risk of mountain pine beetle attack, and represent potential for some level of mortality and snag creation in the near future.

In addition to dense stands undergoing mountain pine beetle infestation, the Grizzly Gulch Fire, which burned in 2002, created about 3,020 acres of suitable habitat on Forest Service acres within the project area. Treatments under this project do not propose to enter areas affected by the Grizzly Gulch Fire.

Application of underburning in moderately dense stands is not expected to negatively impact this species since structural stages will not change.

Cumulative effects: With an emphasis in the Black Hills toward thinning stands to reduce insect, disease, and wildfire risk, the trend of habitat availability for this species is likely to be downward. However, recent wildfires across the Forest have created a substantial amount of suitable habitat. Recently modified Forest Plan standards that require habitat retention for big game, marten, and goshawk, as well as minimum retention levels of snags and green tree replacements are expected to favor habitat retention for black-backs in the long-term. Approximately 3,020 acres of suitable habitat created by the Grizzly Gulch Fire are not proposed for salvage entry on Forest Service acres by any project at this time. Salvage activities are however, underway on private and BLM lands.

Several vegetation management projects are currently occurring or are reasonably certain to occur within the project area, including Boulder, Redhill, Piedmont, Kirk, Cavern, and

Danno timber sales, and sales associated with Public Law 107-206. Existing potential suitable habitat for black-backs totals 8,108 acres or 19% of pine acreage, when taking into account these projects. Cumulatively, alternatives 2, 3, and 4 would retain potential suitable habitat to 19% of pine acreage. Management actions taken cumulatively may impact individuals, but are not expected to cause a trend to federal listing or a loss of species viability range-wide.

Determination: There would be no impact under alternative 1; alternatives 2, 3, and 4 may adversely impact individuals, but not likely to result in a loss of viability, nor cause a trend to federal listing.

Northern three-toed woodpecker (Picoides tridactylus)

Habitat summary: Suitable habitat includes bug killed stands and large burns in conifer associations, and closed canopy mature and old growth spruce associated with aspen in undisturbed habitat (Mohren 2002).

Distribution: The species is a rare resident in the higher elevations of the Black Hills and has been documented in a few locations in Lawrence, Pennington and Custer Counties. It is listed as absent in northeastern Wyoming (WGF1992).

Threats: This species is vulnerable to loss of dense habitat with large snags, salvage timber harvest and fire suppression.

Direct/Indirect effects: In undisturbed habitat, this species is generally associated with older spruce, which is represented on only 305 acres within the Elk Bugs and Fuel project area. No stands of spruce are proposed for treatment under this project.

Population irruptions have been noted in areas with large-scale disturbance such as wildfires and insect outbreaks (Hutto 1995, Yeager 1955, Murphy and Lehnhausen 1998). In addition to habitat created by the Grizzly Gulch Fire, which burned aver 3,000 acres within the project area, ponderosa pine mortality is occurring due to the mountain pine beetle epidemic, which may attract use by three-toed woodpeckers.

Alternative 1 would maintain the current 23% of ponderosa pine stands in potential suitable habitat. The action alternatives would also retain potential habitat within 23% of pine acres. Acres remaining in 4C are at high risk of mountain pine beetle attack, and represent potential for some level of mortality and snag creation in the near future.

Application of underburning in dense stands is not expected to impact this species since structural stages will not change. Consumption of large logs used as potential foraging is expected to be minimal.

Cumulative effects: Cumulative effects are similar to those discussed for black-backed woodpecker.

Determination: There would be no impact under alternative 1. Alternatives 2, 3, and 4 may adversely impact individuals, but not likely to result in a loss of viability, nor cause a trend to federal listing.

Lewis' Woodpecker (Melanerpes lewis)

Habitat summary: Habitat occurs within burns, also in large, open pine (structural stages 4A, 5), and deciduous riparian with snags >19".

Distribution/abundance: In the Black Hills, this species is considered a locally uncommon summer resident (locally common in large burns). This species has been documented in all counties in the Black Hills of South Dakota and Wyoming.

Threats: This species is vulnerable to loss of large snags and large diameter trees through timber harvest.

Direct/Indirect effects: Current available habitat occurs within structural stage 4A, however, most of these stands are marginal due to small tree and snag size. Alternative 1 and would maintain the current 28% of the ponderosa pine cover type that may be marginally suitable due to smaller tree diameters, but is expected to become suitable in the future as tree growth occurs. Alternatives 2, 3, and 4 would increase 4A stands to 31%, 32%, and 32% of ponderosa pine, respectively. No overstory removal treatments are proposed under any alternative.

Phase I snag requirements would ensure that the large diameter trees are left/promoted and that large snags are available long-term in all treatment units. Standard silvicultural thinning to 60-80 basal area on the commercial thins will also open the canopy, thereby accelerating development of large-diameter trees and snags. Prescribed burning and underburning will not affect habitat for Lewis' woodpecker, and may enhance stands by removing competing understory trees.

Cumulative effects: The Forest-wide trend toward increased commercial thinning and seed tree retention cuts presents long-term habitat benefits at the landscape level. Due to current lack of large trees on the landscape, treatments that remove large trees, such as overstory removal, are likely to create habitat gaps. Snag standard 2306 will ensure maintenance/creation of large diameter trees and snags over time and will eventually benefit the species. As suitable large diameter trees/snags develop over time in the open habitat, downward population trends should be reversed.

Several vegetation management projects are currently occurring or are reasonably certain to occur within the project area, including Boulder, Redhill, Piedmont, Kirk, Cavern, and Danno timber sales, and sales associated with Public Law 107-206. Existing potential suitable habitat for Lewis' woodpecker totals 11,635 acres or 28% of pine acreage, when taking into account these projects. Cumulatively, alternatives 2, 3, and 4 would all increase potential suitable habitat to 35%. Management actions taken cumulatively may impact individuals, but are also expected to benefit this species. Cumulatively, no trend toward federal listing or loss of species viability is expected.

Determination: Alternative 1 would have no impact, but would fail to increase acres of potential habitat. All action alternatives would increase potential habitat for this species. Since individual trees used by this species may be harvested, the action alternative may adversely impact individuals, but not are likely to result in a loss of viability, nor cause a trend to federal listing.

Pygmy Nuthatch (Sitta pygmaea)

Habitat summary: open pine structural stage 4A, 5; needs snags > 17" dbh.

Distribution/abundance: In the Black Hills, this species is an uncommon permanent resident and nest regularly in the southern and lower elevations of the hills (SDOU 1991). Sightings of this species within the Black Hills have been very rare (Panjabi 2003).

Threats: This species is vulnerable to loss of large snags and large diameter trees through timber harvest.

Direct/Indirect effects: Similar to those described for Lewis' woodpecker.

Cumulative effects: Similar to those described for Lewis' woodpecker.

Determination: Alternative 1 would have no impact. All action alternatives would increase potential habitat for this species. Since individual trees used by this species may be harvested, the action alternative may adversely impact individuals, but not are likely to result in a loss of viability, nor cause a trend to federal listing.

Flammulated Owl (Otus flammeolus)

Habitat summary: Larger diameter (18-29 inches, McCallum 1994) mature and old growth open-grown ponderosa pine for nesting and foraging; dense pine or mixed conifer stands for roosting.

Distribution/abundance: This species was unknown in the Black Hills until several recent sightings. Surveys for this species have not occurred in the Black Hills. Current distribution and density is unknown.

Threats: Removal of large-diameter snags; overstory removal of large-diameter ponderosa pine.

Direct/Indirect effects: Alternative 1 would maintain existing conditions, which consist of 10,183 acres (25% of pine acreage) of mostly small-diameter (9-13 inches) open pine stands that may serve as suitable nesting/foraging habitat, but is most likely marginal due to the small size. An abundance of roosting habitat (21,907 acres in habitat structural stages 4B and 4C) would be maintained across the landscape.

The action alternatives would create and maintain more acres in pine structural stage 4A, totaling 31% of pine acreage. While existing diameters may be small, and therefore marginally suitable, lower basal area will allow these stands to accelerate to a large-diameter condition in the future. All action alternatives would provide more acres of future suitable nesting habitat than alternative 1. The action alternatives would maintain between 45% and 46% of pine acreage in potential roosting habitat. Underburning may impact individuals due to smoke, but he effect will be minor due to the short duration of smoke presence in the stand.

All action alternatives have the potential to remove existing snags that pose a safety problem in treatment units, and therefore could reduce suitable nesting habitat. However, since snag removal is expected to be rare, and existing habitat in treatment units is marginally suitable for nesting, this action may impact individual owls, but are not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing or a loss of species viability range-wide.

Cumulative effects: Current planning efforts for vegetation management projects on the Northern Hills Ranger District emphasize thinning of dense stands. Thinning treatments applied across the landscape are expected to increase future suitable habitat for this species by accelerating tree growth and reducing the potential loss of overstory trees to insects, disease, and wildfire.

Several vegetation management projects are currently occurring or are reasonably certain to occur within the project area. Existing potential suitable nesting and foraging habitat for Flammulated owls totals 11,635 acres or 28% of pine acreage, when taking into account these projects. Cumulatively, alternatives 2, 3, and 4 would all increase potential suitable nesting and foraging habitat to 35%. Management actions taken cumulatively may impact individuals, and would benefit this species. Cumulatively, a trend toward federal listing or a loss of species viability range-wide is not expected.

Determination: Alternative 1 would have no impact. Since individual trees used by this species may be harvested, the action alternatives may adversely impact individuals, but are not likely to result in a loss of viability, nor cause a trend to federal listing. The action alternatives would benefit this species in the long-term by increasing available habitat.

Marten (Martes americana)

Habitat summary: spruce, predominantly structural stages 3B, 3C, 4B, 4C and 5 and pine 3B, 3C, 4B, 4C, and 5 with greater than 30% basal area in spruce and greater than 40% crown closure.

Distribution/abundance: Pine marten historically occurred within the Black Hills, but are thought to have been trapped out by 1930. Forty-two marten were re-introduced on the Spearfish District near Cheyenne Crossing between 1980 and 1981 (Fredrickson, 1989). Marten are frequently sighted near the re-introduction sites and by 1988 had spread to as far away as Cement Ridge, Galena, Bridal Veil Falls, and Higgins Gulch. Known and predicted pine marten distribution patterns show similar trends indicating that the distribution of pine marten is contained within a region that extends from the northern Black Hills, southeast to the Norbeck Wildlife Preserve and Black Elk Wilderness Area in the central Black Hills. The population has been increasing since 1980 with current population estimated at 580 individuals (SD GF&P unpublished data).

Threats: Trapping is regulated; susceptible to habitat loss and degradation from forest management activities.

Direct/Indirect effects: No treatment would occur in marten habitat (spruce) under any alternative. Alternative 1 would maintain existing dense pine stands that serve as potential movement corridors. The action alternatives treat dense pine, and therefore, may influence marten movement across the landscape. The creation of fuel breaks across the landscape has the potential to influence and possibly limit marten movements within the project area. However, Mitigation #4 (Appendix A) is expected to retain suitable connective habitat for marten.

Cumulative effects: Vegetation management activities that are ongoing or reasonably certain to occur within the project area were assessed for impacts to spruce habitat. The amount of spruce acres, as well as the structural stages of these stands, would not change cumulatively. No negative cumulative impact to this species is expected to occur as a result of management actions.

Determination: There would be no impact on marten under alternative 1. Since marten movement on the landscape could be influenced, the action alternatives may adversely impact individuals, but are not likely to result in a loss of viability, nor cause a trend to federal listing.

Townsend's Big-eared Bat (Corynorhinus townsendii)

Habitat summary: suitable caves, mineshafts.

Distribution/abundance: Known from Fall River, Custer, Pennington, Lawrence, Meade counties in SD and Crook County, WY. Eastern sub-species listed as endangered. Suspected downward trend across species range including the Black Hills (Western Bat Working Group). Uncommon relative to other bat species based on hibernacula counts conducted in the Black Hills. Known population Forest wide is estimated at 1500 –1800 (Jewel Cave Counts, unpublished).

Threats: Winter habitat is declining due to mine closure/collapse and recreational use of caves. Hibernacula and maternity roosts highly sensitive to disturbance.

Direct/Indirect effects: None of the alternatives propose harvest adjacent to known caves on federal land. Preventing mine collapse and limiting recreational use are outside the scope of this document. No conflicts are known at this point.

Cumulative effects: No negative cumulative effects are expected for this species.

Determination: There will be no impact on Townsend's big-eared bat populations under any alternative.

Fringed-tailed myotis (Myotis thysanodes)

Habitat summary: This species feeds mainly on small moths high in the forest canopy and on or near the ground near thick or thorny vegetation. They may occasionally glean insects from leaves (Barbour and Davis, 1969). Suitable caves and mine shafts are used as roosting, maternity sites and hibernating.

Distribution/abundance: Known locations are found in Lawrence, Meade, Pennington and Custer Counties of South Dakota and possibly Crook and Western Counties in Wyoming (Schmidt 2003a). Factors that affect this species are human disturbance of roosting and hibernation sites, low reproductive rate and habitat loss. Disturbance by humans, especially in hibernacula and maternity roosts, can be a threat to survival of these animals (Barbour and Davis 1969).

Threats: Disturbance to hibernacula and maternity roosts, loss of habitat due to mine closure/collapse.

Direct/Indirect effects: None of the alternatives propose harvest adjacent to known caves on federal land. Preventing mine collapse and limiting recreational use are outside the scope of this document. No conflicts are known at this point.

Cumulative effects: No negative cumulative effects are expected for this species.

Determination: There will be no impact on fringed-tailed myotis individuals or populations; risk levels are low.

Cooper's Rocky Mountain Snail (Oreohelix strigosa cooperi)

Habitat summary: Moist woodlands adjacent to riparian areas; generally spruce with aspen/birch on north aspects with limestone derived soils.

Distribution/abundance: This species is common in Spearfish Canyon drainages and occurs elsewhere in scattered populations (Frest and Johannes 2002). A total of 4 sites within the project area were surveyed for this species (Frest and Johannes 1993, 2002). No specimens were found.

Threats: Drying of site through extensive logging, overgrazing of riparian areas especially around seeps and springs.

Direct/Indirect effects: Spruce habitat would remain unaltered under all alternatives. No positive sites for this species are known within the project area.

Cumulative effects: Forest Plan standard 3215 ensures existing spruce stands will be retained Forest-wide. No negative cumulative effects are expected for this species.

Determination: Risk levels are low. There would be no impact on snail populations.

Cockerell's Striate Disc Snail (Discus shimeki cockerellii)

Habitat summary: Moist woodlands north-facing slope bases adjacent to spruce with a deciduous association on north aspects with limestone derived soils (Frest and Johannes 2002).

Distribution/abundance: In the Black Hills, this species is locally abundant in a limited number of colonies. A total of 4 sites were surveyed for this species within the project area (Frest and Johannes 1993, 2002). No specimens were found.

Threats: Drying of site through extensive logging, overgrazing of riparian areas.

Direct/Indirect effects: No occurrence of this species within the project area is known. Potential habitat associated with spruce would not be affected under any alternative.

Cumulative effects: Forest Plan standard 3215 ensures existing spruce stands will be retained Forest-wide. No negative cumulative impacts are expected.

Determination: Risk levels are low. All alternatives would have no impact on snail populations due to a lack of treatment in potential habitat.

Northern Leopard Frog (Rana pretiosa)

Habitat summary: cattail marshes, beaver ponds, small stock ponds, permanent water sources.

Distribution/abundance: Known from all Black Hills counties. Listed as in suitable habitat (Smith 2003). Creation of small stock ponds may have increased the availability of breeding sites and habitat for this species of frogs. Habitat appears stable, but can be affected by management activities such as grazing, timber, and roads.

Threats: Vulnerable to habitat loss/alteration from overgrazing, predation, and reduced water quality/quantity.

Direct/Indirect effects: Suitable habitat occurs on much of the project area. However, breeding habitat is limited to riparian areas, old beaver ponds, dugouts, and springs. All alternatives would maintain the current breeding habitat. The action alternatives could temporarily disrupt habitat as downed logs are potentially shifted during logging operations. Grazing impacts, both positive and negative, would be dealt with in Allotment Management Plans and associated environmental analyses. Prescribed burning and underburning would not occur in suitable breeding habitat.

Cumulative effects: No cumulative effects are expected for this species.

Determination: Risk levels are low. Alternative 1 would have no impact. Alternatives 2, 3, and 4 may impact individuals, but are not likely to cause trend toward federal listing or loss of viability due to displacement rather than loss of habitat.

Tiger Salamander (Ambystoma tigrinum)

Habitat summary: temporary pools, damp meadows, under debris.

Distribution/abundance: No local population trend data is available, but habitat appears stable.

Threats: Loss of riparian and other breeding habitat and reduced water quality.

Direct/Indirect effects: Suitable habitat occurs on much of the project area. However, breeding habitat is limited to riparian areas, old beaver ponds, dugouts, and springs. All alternatives would maintain the current habitat. Alternatives 2, 3, and 4 could temporarily disrupt habitat as downed logs are potentially shifted during logging operations. Prescribed burning could impact distribution of individuals in upland habitat, but is not expected to affect breeding habitat.

Cumulative effects: Water quality can be affected by livestock and mining. These factors are outside the scope of this project and would be addressed in Grazing EAs or mining plans of operation. Grazing operations can have a beneficial effect by creating additional water sources.

Determination: Risk levels are low. Alternatives 1 would have no impact. Alternatives 2, 3,and 4 could impact individuals, but no trend toward federal listing, nor loss of viability is expected.

Black Hills Red-bellied Snake (Storeria occipitomeoculata pahasapae)

Habitat summary: beneath downed logs, slash, debris, and rocks in forests between 4,700 and 6,400 feet elevation (Smith and Stephens 2003).

Distribution/abundance: Range of this subspecies is limited to the Black Hills of western South Dakota and northeastern Wyoming. This species is endemic, uncommon (survey data limited) and has been documented in all counties (Thompson and Backlund, no date). There is no local population trend data available. Not much is known on distribution, abundance and dispersal due to secretive behaviors.

Threats: Minimal. May be susceptible to predation where ground cover is lacking.

Direct/Indirect effects: The entire planning area is considered suitable habitat for the red-bellied snake. Displacement of individuals may occur under the action alternatives as downed logs are potentially moved during skidding operations; however, downed logs would not be removed from the site. Forest Plan standard 2308 provides direction for

maintaining down woody debris in logging units. No barriers adjacent to wetlands would be created under any action alternative.

Prescribed fire would be applied in suitable habitat. Individuals may be impacted due to reductions in forest floor litter and structure, but overall distribution and abundance of this species would not be compromised. Prescribed burning may cause individual snake mortalities, but no impacts to populations are expected.

Cumulative Effects: No negative cumulative effects are expected for this species.

Determination: Risk levels are low. Alternative 1 would have no impact. Alternatives 2, 3, and 4 may impact individuals, but not likely to cause trend to federal listing, nor loss of viability due to displacement rather than loss of habitat.

Pale Milk Snake (Lampropeltis triaulum)

Habitat summary: Occupies very diverse habitat types from semiarid to damp coastal bottomlands to Rocky Mountain and tropical hardwood forests, pine forests, open deciduous woodlands, rocky hillsides, sand dunes, meadows, prairies, high plains, farmland, and suburban areas to 8000 feet elevation. This species is secretive and nocturnal, generally found under rotting logs, stumps, or decaying trash (Behler and King 1979).

Distribution/abundance: In the Black Hills, this species is rare (survey data limited) but have been documented in all counties at lower elevations (Thompson and Backlund, no date). Not much is known on distribution, abundance and dispersal due to secretive and nocturnal behaviors.

Threats: Minimal. May be susceptible to predation where ground cover is lacking.

Direct/Indirect Effects: The entire planning area is considered suitable habitat for the milk snake. Displacement of individuals may occur under the action alternatives as downed logs are potentially moved during skidding operations; however, downed logs would not be removed from the site. Forest Plan standard 2308 provides direction for maintaining down woody debris in logging units. Prescribed burning may cause individual snake mortality, but no impacts to populations are expected.

Cumulative effects: No negative cumulative effects for this species are expected.

Determination: Risk levels are low. Alternative 1 would have no impact. The action alternatives may impact individuals, but not likely to cause a loss of viability or trend toward federal listing due to displacement rather than loss of habitat.

Tawny Crescent Butterfly (Phyciodes batesi)

Habitat summary: This species is restricted to moist forest borders, particularly riparian areas, and moist valley bottoms in the transition between deciduous and coniferous forests (Royer and Marrone 1992). Specimens have been collected on the District.

Distribution/abundance: In the Black Hills, this species is known in Lawrence, Pennington, Meade and Custer counties in South Dakota and Crook and Weston counties in Wyoming with being rare to uncommon at known sites. There is no local population trend data available but this species has been disappearing from its range in the eastern United States.

Threats: habitat loss (e.g. riparian areas), pesticide/herbicide application, and lost of host species (Royer and Marrone 1992).

Direct effects: Riparian areas within the project area are associated with meadows or aspen. No alteration of existing hydrological function or riparian character is expected under any alternative.

Cumulative effects: No pesticides are currently being used on the Northern Hills Ranger District. Herbicides are being applied locally, targeting patches of noxious weeds, but riparian areas are generally avoided. No negative cumulative impacts for this species are expected.

Determination: Risk levels are low under all alternatives. No impacts are expected.

Mitigation

Objectives, standards and guidelines have been identified in the Forest Plan BA/BE that provides mitigation for all Federally listed and Region 2 Sensitive Species found in the Black Hills. This project will follow the objectives, standards, and guidelines that are applicable to species and habitats found within the Elk Bugs and Fuel analysis area. Mitigation measures are found in the Elk Bugs and Fuel wildlife specialist report, the 1996 Revision-Land and Resource Management Plan (BHNF) and 2001 Phase 1 Amendment Decision Notice (BHNF). Mitigations are incorporated into this document by reference and form the basis for the determinations.

Determination of Effects

The determination of effects on Federally listed species and Region 2 Sensitive Species in this document, were made as the result of the information gathered in the pre-field review, field reconnaissance and effects analysis. The basis for these determinations was potential habitat, distribution, effects from forest activities and proposed mitigation. The determination language is set forth in Forest Service Manual 2670 and by the U.S. Fish and Wildlife Service.

With implementation of the mitigation measures, a determination of "No effect" would apply to all Federally listed species that may be found in Elk Bugs and Fuel (bald eagles). With implementation of the mitigation measures, the Forest Plan BA/BE determinations of "No impact", "Beneficial impact", or "May adversely impact individuals, but not likely to result in a loss of viability, nor cause a trend to federal listing" would apply to Region 2 sensitive species found in the project area. Any non-compliance with mitigations identified in Appendix A could alter the determination and lead toward trends to Federal listing. Individual determinations are summarized in Table 84 below.

Table 28 List of all wildlife species known or suspected to occur in the Elk Bugs and Fuel Analysis Area.

(Impact may occur in more than one column depending upon alternative.)

Species	No Impact	Beneficial Impact	May Impact Individuals	May Impact Population
Bald eagle	All			
Northern goshawk	Alt 1		Alt 2, 3, 4	
Black-backed woodpecker	Alt 1		Alt 2, 3, 4	
Northern 3-toed woodpecker	Alt 1		Alt 2, 3, 4	
Lewis' woodpecker	Alt 1	Alt 2, 3, 4	Alt 2, 3, 4	
Pygmy nuthatch	Alt 1	Alt 2, 3, 4	Alt 2, 3, 4	
Flammulated owl	Alt 1	Alt 2, 3, 4	Alt 2, 3, 4	

Marten	Alt 1		Alt 2, 3, 4	
Townsend's big-eared bat	All			
Fringed-tailed myotis	All			
Cooper's Rocky Mt. snail	All			
Cockerell's striate disc snail	All			
Northern leopard frog	Alt 1		Alt 2, 3, 4	
Tiger salamander	Alt 1		Alt 2, 3, 4	
Pale milk snake	Alt 1		Alt 2, 3, 4	
Black Hills red-bellied snake	Alt 1		Alt 2, 3, 4	
Tawny crescent	All			

Consultation with U.S. Fish and Wildlife Service

On July 14, 1998 the USFWS informed the Forest that review of Biological Assessments with "No Effect" determinations is no longer required. Determinations of "May Affect" will be sent to USFWS as usual and concurrence received before decision documents are signed. There are no additional changes to the Forest Plan operating criteria and no additional information has become available that would change Forest Plan analysis of threatened, endangered, or sensitive species.

Management Indicator Species (MIS)

White-tailed deer, Mule deer, and Elk

The project area currently supports herds of both white-tailed deer and elk, with mule deer being rare in much of the area. Numbers of white-tailed deer have declined in the Black Hills since the middle 1970s (Griffin et al. 1994). Diminished habitat quality has been implicated as a primary cause of deer reductions since fawn production and recruitment remain low (Anderson 1998, Deperno et al. 2000). Deperno et al. (2002) implicated the general lack of shrubs on the landscape as a factor contributing to deteriorated deer habitat and recommended that aspen regeneration and prescribed burning be applied to improve habitat quality. Sieg and Severson (1996) stated that the value of stands with 80 to 120 square feet of basal area is minimal as deer summer range habitat, and recommend aspen regeneration and thinning pine to low densities followed by underburning as techniques for improving forage quality and quantity.

The project area lies within deer and elk summer range. Current habitat conditions in the project area include 53% of the ponderosa pine cover type in moderate or high density mature stands with no viable forage in the understory. Open understory pine stands currently total 25% of the same cover type. Hardwood stands are slowly transitioning to conifer as more pine becomes established. Ponderosa pine are also encroaching into

meadows not treated for pine removal in past vegetation management projects. Cover in the form of 3C and 4C stands constitutes 31% of ponderosa pine acres, and open road densities average just above 3 miles per square mile. Existing habitat suitability would remain unchanged under alternative 1.

Treatments under the action alternatives would remove encroaching pine from hardwood stands and meadows, regenerate some aspen stands, reduce ponderosa pine stand densities, enhance the grass/forb/shrub component by underburning, and reduce mileage of open roads. Open understory ponderosa pine would increase from 25% under the no-action alternative to 31%, 32%, and 32% of ponderosa pine acres under alternatives 2, 3, and 4, respectively. Table 85 displays the acres of big game habitat improvement activities and open road densities by alternative.

Table 29 Habitat Improvement Activities and Road Densities.

Treatment	Alt 1	Alt 2	Alt 3	Alt 4
Prescribed burn (ac.)	0	339	4852	2943
Hardwood maintenance (ac.)	0	323	323	323
Meadow maintenance (ac.)	0	0	229	0
Patch cutting (ac.)	0	0	*594	0
Open road density (mi/sq. mi)	3.1	2.3	2.4	2.4

* The intent of this prescription is to create habitat diversity within monocultures of young regenerating pine stands. Treatments include removing all trees within an area 2-10 acres within a given treatment stand. Patch cuts would equal approximately 25% of acreage within a given treatment stand, and would not exceed 30% of stand acreage. More than one patch cut may be created within a treatment stand. Treatment of residual slash in patch cuts would include one or more of the following applications: lop and scatter, pile and burn, prescribed burn.

*Up to 30% of 594 acres of prescribed non-commercial thinning will have scattered patch cuts of 10 acres or less.

All action alternatives would reduce available cover to 29%, 29%, and 28% in the ponderosa pine cover type for alternatives 2, 3, and 4, respectively. However, Alternative 2 would reduce open road densities to 2.3 miles per square mile, while alternatives 3 and 4 would reduce open roads to 2.4 miles per square mile.

Habitat Effectiveness

Habitat effectiveness is an area's capability to support elk or deer based on amount and spatial distribution of forage, cover, and open roads. Habitat effective values are based on a score of 0-1000 with higher values representing more effective habitat. Revised Forest Plan standards and guidelines state minimum habitat effectiveness values that apply to Management Areas 3.31, 3.32, 5.1, 5.2a, and 5.4, all of which occur within the project area.

Habitat effectiveness values were calculated for the above Management Areas (Table 86). Management Areas 5.1(general forest) and 5.4 (deer winter range) comprise the majority of project area acres (88%).

Table 30 Habitat Effectiveness Values by Alternative

	Habitat Effectiveness Values			
	Alt 1	Alt 2	Alt 3	Alt 4
Elk (summer)				
MA 3.31	475	475	475	475
MA 3.32	619	601	585	595
MA 5.1	576	581	582	581
MA 5.2A	587	566	560	567
MA 5.4	568	583	580	581
Elk (winter)				
MA 3.31	370	370	370	370
MA 3.32	622	555	594	547
MA 5.1	520	510	520	510
MA 5.2A	577	549	544	547
MA 5.4	520	520	521	515
WT Deer (summer)				
MA 3.31	403	403	403	403
MA 3.32	455	497	460	492
MA 5.1	526	531	533	532
MA 5.2A	526	505	504	506
MA 5.4	501	512	514	510
WT Deer (winter)				
MA 3.31	363	363	363	363
MA 3.32	552	497	528	490
MA 5.1	483	475	485	475
MA 5.2A	521	495	490	493
MA 5.4	474	475	477	470

As shown above, habitat effectiveness (HE) values are currently above the minimum guidelines for all species and seasons (alternative 1). All action alternatives meet Forest Plan standards by maintaining habitat effectiveness above minimum thresholds in each management area (MA). Within MA 5.1, alternative 3 maintains the highest HE for all species and seasons. Alternative 1 equals the HE for alternative 3 in the elk/winter classification. Results for MA 5.4 vary by zone and alternative with Alternative 2 reaching the highest HE for the elk/summer classification, while alternative 3 shows the highest HE for all other species/seasons. No difference in HE occurred in MA 3.31. In MA 3.32, alternative 1 shows the highest HE for 3 species/seasons, with alternative 2 showing highest HE for deer/summer. Alternative 1 also showed the highest HE in all four categories within MA 5.2a.
Road density is the primary limiting factor in the project area. The action alternatives would reduce open road densities from an existing 3.1 miles per square mile to approximately 2.4 miles per square mile. The planning team determined that further decreases were not possible at this time for the following reasons:

1. Private land access needs to be retained. Approximately 15,605 acres of land in other ownership is intermixed with National Forest System land, and other private parcels are adjacent to the project area.

2. The State snowmobile trail system runs on a number of National Forest System and non-system roads. It crosses other roads. The trail is generally wide enough for passenger vehicles, and many sections are used in summer and fall by all-terrain vehicles and four-wheel-drive trucks. Using the snowmobile trail for access, users can intentionally or unintentionally circumvent road closures.

3. Relatively flat terrain in much of the project area makes effective closure of certain roads especially difficult or expensive.

Merriam's Turkey

Turkey habitat consists of a mix of structural stages in all cover types. All alternatives retain structural stage mixes that assure suitable habitat within the project area. Roosting habitat will be maintained throughout the project area for all alternatives since no overstory removal is proposed.

Brown Creeper-

Habitat summary: Utilizes dense mature coniferous (pine and spruce, 4B, 4C, 5), mixed deciduous woodlands, especially old growth forests. Nests under loose bark of dead trees > 10" dbh. Winters in more open stands.

Distribution/abundance: Known in several scattered locations in the Black Hills.

Threats: Loss of habitat to logging and wildfire.

Direct/Indirect effects: Alternative 1 would have no impact. Existing dense stands (53% of ponderosa pine cover type) would remain unchanged, with short-term snag increases due to the current mountain pine beetle epidemic. However, the project area currently shows a lack of large trees as well as late and old forest structure (currently 47 acres of structural stage 5) across the landscape. Existing dense stands (4B and 4C) may be used by this species, but the optimum habitat is identified as old growth (structural stage 5). Without treatments to release some denser stands, the rate at which structural stage 5 is developed on the landscape would be very slow.

All action alternatives would reduce availability of potential habitat, with remaining habitat at 45% of pine acres for alternatives B, D, and F. No treatments are proposed in structural stage 5 stands.

Since commercial thinning, as proposed in this project, emphasizes retention and release of larger trees, growth rates in these trees would be more rapid than if the stand were left untreated. Thus, the action alternatives would create short-term losses in habitat availability, but if at least a portion of these stands were managed for late and old structure in the future, optimal habitat (structural stage 5) would be available on the landscape much sooner than under alternative 1.

Cumulative Effects: With an emphasis in the Black Hills toward thinning stands to reduce insect, disease, and wildfire risk, the trend of habitat availability for this species is likely to be downward, at least in the short-term. However, recently modified Forest Plan standards that require habitat retention for big game, marten, and goshawk, as well as minimum retention levels of snags and green tree replacements are expected to prevent habitat loss that affects populations at the planning area level. In order for habitat conditions to improve over time, some stands must be managed indefinitely for late and old structure.

Determination: Alternative 1 would have no impact. Due to short-term loss of habitat, the action alternatives may impact individuals. Since all alternatives remain habitat throughout the project area, none are likely to result in a loss of viability on the planning area, nor cause a trend to federal listing or a loss of species viability range-wide.

Mountain Lion

Treatments that benefit deer and elk, a main prey species, are likely to benefit mountain lion. Improved big game habitat effectiveness under the action alternatives indicates better habitat for deer and elk. Mountain lion denning habitat is scattered throughout the project area and would not be affected by any alternative.

Mountain Goat

There is no suitable habitat for mountain goats within the project area.

Other Species

American Dipper (Cinclus mexicanus)

Trend/Distribution: This species is known to occur in Spearfish Creek, and distribution is likely very isolated. Distribution and trend information derived from breeding bird surveys (BBS) and Christmas bird counts (CBC) do not provide sufficient data to establish forest-wide trends for this species (Anderson 2002). South Dakota Department of Game and Fish established a dipper monitoring route along Spearfish Creek in 1993. Annual survey results vary widely mainly due to winter severity and the introduction of nest boxes in 2001 (Backlund 2003). Backlund (1994) found dippers in Spearfish Creek, Iron Creek, Little Spearfish Creek, East Spearfish Creek, and Whitewood Creek.

Suitable Habitat: Dippers are normally found associated with cold, fast-flowing, rocky streams with high water quality. Habitat is considered streams, banks, and streamside habitat since nests are no more than a meter from water (Backlund 2003). They prefer a stream bottom with rocks, sand, and rubble (Anderson 2002).

Threats: Stream sedimentation, dams, water pollution, wildfire, severely cold winter, loss of stream flow due to diversion.

Direct/Indirect Effects: Upland treatments within the project area are within drainages that feed into several streams where dippers could potentially occur, including Bear Butte, Elk, and Whitewood Creeks. Backlund (2003) describes Whitewood Creek adjacent to the project area as having environmental problems that preclude the stream from being considered good long-term habitat. He also states that Bear Butte Creek did not historically support dippers, but nesting birds have been reported below Galena. Dippers were originally reported from Elk Creek in 1874. Backlund describes Elk Creek as poor habitat due to high levels of sedimentation and low flows.

Treatments, including timber harvest, noncommercial thinning, prescribed burning, road decommissioning, road reconstruction, and new road construction are proposed within the Whitewood, Bear Butte Creek, and Elk Creek drainages. Soils in this area are classified as moderate to high potential for erosion (see Soils/Hydrology section of the

EA), so there is potential for management activities to cause additional sediment delivery to stream systems. However, application of mitigation measures, Forest Plan standards and guidelines, and Best Management Practices related to roads and timber harvest, is likely to minimize sediment delivery as well as minimize potential impacts to water quality (see Soils/Hydrology section of the DEIS) and dipper habitat.

Project activities are not expected to affect water flow regimes. No increase in pollutants into any water system is expected as a result of project activities. No impact to stream morphology or potential nesting substrate is expected. Due to a lack of potential impact to dipper habitat that is apparently already degraded, no negative impacts to potential habitat would occur. No negative impacts to local American dipper populations are expected.

Cumulative Effects of Public Law 107-206 Activities Outside the Project Boundary

The cumulative effects area outside the project boundary includes 45,642 acres of National Forest land and 6,124 acres of other ownership. This area includes the Beaver Park Roadless Area and Surrounding Area described in Civil Action No. 99-N-2173 Settlement Agreement, Exhibit A2, and an additional five 7th order watersheds, which encompass activities undertaken due to Public Law 107-206.

Fire suppression and mountain pine beetle control are activities that have shaped vegetation on the Black Hills over the past 120 years. In comparison to historical conditions, today's ponderosa pine stands are more dense and extensive, leading to loss of meadows due to encroachment, reductions in hardwood stands, and declines in open pine habitat (USDA 1996).

Existing vegetation within this area is shown in Table 87, and consists of ponderosa pine (97%), aspen (0.6%), birch (0.1%), and white fir (2%). Habitat structural stages for ponderosa pine include 64% of pine acres in mature condition, 32% in younger age classes, and 4% in grass, forb, or shrub. Moderate and high density mature stands (4B and 4C) total 45% of all pine acres, while open mature stands (4A) total 19% of pine acres.

Treatments in recently planned timber sales will decrease stand density on approximately 15% of the ponderosa pine cover-type. Treatments that regenerate aspen and pine will occur on less than 1% of the area. Table 88 shows expected acreages of vegetation cover types and habitat structural stages after planned treatments are implemented. Mature pine falls slightly to 62% of pine acres. The amount of moderate and high density pine stands drop to 34% of pine acres, while open mature pine increases to 28%. Management actions reduce white fir acres by 10%, increase aspen by 76%, and increase the grass cover type by 73%. No structural stage within any cover type is completely removed by management actions.

Table 31 Existing Habitat Structural Stages, Cumulative Effects Area

COVER	HABITAT STRUCTURAL STAGE (acres)									
TYPES	**1**	**2**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5**	Totals
GRA	343	0	0	0	0	0	0	0	0	343
TAA	5	211	0	0	0	40	40	0	0	296
TBO	0	0	0	35	0	19	13	0	0	67
TPP	608	1,030	2,095	4,335	7,501	8,207	8,064	1,772	0	43,612
TWS	0	0	43	56	0	508	168	71	0	846
Totals	957	1,243	2,138	4,426	7,501	8,774	8,285	11,843	0	45,167

Table 32 Post-Treatment Habitat Structural Stages, Cumulative Effects Area

COVER	HABITAT STRUCTURAL STAGE (acres)									
TYPES	**1**	**2**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5**	Totals
GRA	593	0	0	0	0	0	0	0	0	593
TAA	18	204	204	0	0	74	22	0	0	522
TBO	0	0	0	35	0	19	13	0	0	67
TPP	918	2,051	3,693	3,982	5,740	12,058	6,519	8,261	0	43,222
TWS	0	0	43	56	0	446	144	71	0	760
Totals	1,530	2,257	3,940	4,073	5,740	12,597	6,698	8,332	0	45,167

Threatened, Endangered, or Sensitive Species

As a result of management actions, impacts to threatened, endangered, sensitive, or management indicator species that may occur within the analysis area are expected to vary. No impact to bald eagle would occur due to a lack of nesting habitat. Habitat for species associated with moderate and high density pine stands, including northern goshawk, black-backed and three-toed woodpecker, and brown creeper, would decline. However, due to the relatively large amount of potential suitable habitat remaining within the analysis area, impacts are not likely to cause a trend toward federal listing or loss of viability.

Species associated with open stands of mature ponderosa pine, including pygmy nuthatch, flammulated owl, and Lewis' woodpecker, are likely to benefit from increased acres of potential suitable habitat. Species that rely on meadow habitat (loggerhead shrike, regal fritillary butterfly) are also expected to benefit due to increases in suitable habitat. Species with less specialized habitat requirement (smooth green snake, Black Hills red-bellied snake) may be affected individually, but no trend toward federal listing or loss of viability is expected. Other species for which suitable habitat would not be affected (Townsend's big-eared bat, fringe-tailed myotis, northern leopard frog), would have no impacts.

Suitable habitat for marten (white fir) would decrease slightly. Due to the relatively minor reduction, no trend toward federal listing or loss of viability is expected.

Management Indicator Species (MIS)

No cumulative impacts to Merriam's turkey, mountain lion, or mountain goat are expected due to a lack of impact on suitable habitat. Cumulative impacts to brown creeper are discussed above.

Management actions are expected to have some impact on habitat suitability for big game. Habitat Effectiveness (HE) values were calculated for the cumulative effects area by species, season, and management area (MA). The results are shown in Table 89.

Table 33 Habitat Effectiveness Indices, Cumulative Effects Area.

	HABITAT EFFECTIVENESS	
	Existing	Cumulative
Elk (summer)		
MA 3.32	568	579
MA 4.1	584	626
MA 5.1	526	529
MA 5.4	564	575
Elk (winter)		
MA 3.32	568	594
MA 4.1	584	645
MA 5.1	478	475
MA 5.4	551	544
WT Deer (summer)		
MA 3.32	065	200
MA 4.1	128	481
MA 5.1	500	501
MA 5.4	435	495
WT Deer (winter)		
MA 3.32	450	477
MA 4.1	467	543
MA 5.1	454	450
MA 5.4	498	506

Treatments notably increase HE within MA 3.32 and MA 4.1 for deer/summer and elk/summer habitats. Habitat effectiveness within MA 5.1 showed little change after treatment for all seasons and species. Cumulative treatments in MA 5.4 increased HE for all species/seasons except elk/winter. Treatments within the cumulative effects area outside the project area exceed minimum HE values or improve existing values currently below levels established by Phase 1 Amendment for all management areas, species, and seasons. Therefore, treatments in this area meet Forest Plan standards for big game.

Fisheries

Affected Environment:

Existing Condition

There are seven 6th Level Watersheds within the Elk Bugs and Fuels planning area and aquatic cumulative effects area. Whitewood Creek, Sandy Creek and Slaughterhouse Gulch are located in the Whitewood Creek Watershed (86-01). Bear Butte Creek, Park Creek, Butcher Gulch, Ruby Gulch, Lost Gulch, Vanocker Creek, Deadman Gulch, Strawberry Creek, Boulder Creek, and Two-Bit Creek are located in the Bear Butte Creek Watershed (87-01). Spring Creek is located in the North Spring Creek Watershed (87-02). Alkali Creek is located in the Upper Alkali Creek Watershed (90-01). Elk Creek, Virkula Gulch, Dry Elk Creek, and Meadow Creek are located in the Elk Creek Watershed (88-01). Little Elk Creek is located in the Little Elk Creek Watershed (88-02). Hay Creek is located in the Upper Boxelder Creek Watershed (89-01). Morris Creek, Forbes Gulch, Pleasant Valley Creek, Breakneck Gulch, Tilford Creek, Bulldog Creek, and Syndicate Gulch are located in the North Pleasant Valley Creek Watershed (88-05).

South Dakota has assigned a minimum beneficial use of wildlife propagation, stock water and irrigation to all streams. Page III-72, 1996 Black Hills National Forest, Forest Plan FEIS defines South Dakota stream classes and beneficial uses as follows:

- Class 1-Domestic water supply
- Class 2-Coldwater permanent fish life propagation waters
- Class 3-Coldwater marginal fish life propagation waters
- Class 7-Immersion recreation waters
- Class 8-Limited contact recreation waters
- Class 9-Wildlife propagation/stock watering/irrigation*

- Class 10-Irrigation*

The following Table 90 shows designated Stream Class and Beneficial Uses for within the proposed project area. The table includes the names of all perennial and intermittent streams in the study area listed in the Forest Plan or the 2002 South Dakota 305(b) list. It also shows if streams are meeting their beneficial uses where data exists.

Table 34 Beneficial Use Designation

Stream	Segment	Beneficial Uses
Alkali Creek	From I 90 to S4, T4N, R5E	1,3,8,9,10
Bear Butte Creek	Headwaters to Strawberry	2(P),8(F),9(F),10(F)
	Strawberry Creek to near Bear Den Mountain – Overall use full support	2(F),8(F),9(F),10(F)
Boulder Creek	From Bear Butte Creek to Two Bit Creek	3,8,9,10
Elk Creek		2,7,8,9
Meadow Creek	From Elk Creek to S25, T4N, R4E	3,8,9,10
Park Creek	From Bear Butte Creek to S11, T4N, R4E	3,8,9,10
Strawberry Creek	Headwaters to Mouth	3(P),8(F),9(N),10(N)
Two-Bit Creek	From Boulder Creek to S11, T4N, R4E	3,8,9,10
Vanocker Creek	From Bear Butte Creek to S32, T5N, R5E	3,8,9,10
Whitewood Creek	Spruce Gulch to Sandy Creek	2(P),7(N),8(U),9(F),10(F)
	Sandy Creek to I-90	3(P),7(F),8(F),9(F),10(F)

* Class 9 and 10 denote a difference between the Forest Plan and the State of South Dakota. The Forest Plan defines Class 9 as wildlife propagation/stock watering/irrigation. The State defines Class 9 as Fish/Wildlife Prop/Rec/Stock and places irrigation in Class 10.

F=Fully supportive of assigned use (1 - 10% of values violate standards)

P=Partially supportive of assigned use (11 - 25% of values violate standards)

N=Non-support of assigned use (>25% of values violate standards)

U=Unknown

From a watershed management perspective, the sediment yield from a basin is important because 80 percent of water quality degradation results from erosion. Sediment interacts strongly with other water quality components, and sediment yield is directly affected by land-use activity (Kohler et al 1993). Sediment can smother the spawning and rearing habitat of trout and reduce aquatic invertebrates thereby affecting food availability.

Because of the density of area roads, many of which are adjacent to or cross stream channels, roads are the greatest source and delivery system of sediment to channels (Forest Plan Appendix K 1996). Even disturbed areas far from the drainage system may contribute to sediment if they are connected to the stream by roads, skid trails, ditches or cattle trails. Generally the harvesting of timber itself is not a serious source of soil disturbance. Surveys support the view that improperly located roads and skid trails, and roads and trails without proper drainage rather than the actual harvesting of timber are the greatest cause for concern (Megahan 1975).

The South Dakota Department of Game, Fish and Parks (SDGFP) classify each of the streams by their trout populations based on a 1984-1986 Classification System. The classification system is explained below:

Wild Brook Trout Fisheries:

BKT1: Number of eight inch or greater brook trout exceeds 150/acre.

BKT2: Number of eight inch or greater brook trout is between 25 and 150/acre.

BKT3: Number of eight inch or greater brook trout is less than 25/acre.

Wild Brown Trout Fisheries:

BNT1: Number of eight inch or greater brown trout exceeds 150/acre.

BNT2: Number of eight inch or greater brown trout is between 25 and 150/acre.

BNT3: Number of eight inch or greater brown trout is less than 25/acre.

Wild Rainbow Trout Fisheries:

RBT1: Number of eight inch or greater rainbow trout exceeds 150/acre.

RBT2: Number of eight inch or greater rainbow trout is between 25 and 150/acre.

RBT3: Number of eight inch or greater rainbow trout is less than 25/acre.

Table 35 SDGFB Stream Classifications

Stream	SDGFP Classification	Other
Bear Butte Creek	BKT1, BKT2, BKT3, BKT1/RBT3, BKT2/RBT3	Mountain Sucker present
Hay Creek	BKT2	
		Mountain

Stream	SDGFP Classification	Other
Strawberry Creek	BKT3	Sucker present
Elk Creek	BNT3/BKT1, BNT2/BKT1	Mountain Sucker present
Two Bit Creek	BKT2	
Two Bit Creek W Fork	BKT2	
Whitewood Creek	BNT1/BKT3, BNT3/BKT3	Mountain Sucker present
Meadow Creek	BKT2	Mountain Sucker present

Management Indicator Species Present in the Project Area

The 1997 Revision to the Forest Land and Resource Management Plan identified one aquatic habitat type to use as MIS and the Phase 1 Amendment identified 5 Aquatic Management Indicator Species that are representative of the aquatic communities within the Black Hills National Forest. Selection of these species was based on criteria set forth in the 1982 planning regulations that implement the National Forest Management Act, including the ability to predict changes in their populations in response to management activities.

The following Table 92 details species that may be present in the project area and potentially affected by the proposed management activities:

Table 36 Aquatic Management Indicator Species

Taxa	Scientific Name	Common Name	Potentially Affected Yes/No
Fish	*Salmo trutta*	Brown Trout	Y
Fish	*Salvelinus fontinalis*	Brook Trout	Y
Fish	*Phoxinus neogaeus*	Finescale Dace	N
Fish	*Catostomus platyrhynchus*	Mountain Sucker	Y
Fish	*Couesius plumbeus*	Lake Chub	N

The species and habitat that could be potentially affected by this project will be addressed in detail in the Analysis of MIS Effects section.

Mountain Sucker

Mountain suckers are native to the Black Hills National Forest. They occur in lakes, but most often prefer cold, clear mountain streams with temperatures between 13° and 23°C and moderately swift water velocities (Smith 1966; Sigler and Sigler 1996). Research indicates that mountain suckers occur only in the downstream sections of a stream where channel gradients are lowest and temperatures are warmer than upstream areas suitable only for trout (Gard and Flittner 1974). Underwater observations made by Decker (1989)

revealed that Mountain suckers were always found on the stream bottom, usually occurred in small groups, and were closely associated with cover (e.g., exposed willow or tree root masses, undercut banks, log jams, and boulders). They occur most often near the transitions between pools and runs (Hauser 1969; Decker 1989). Riffle habitats are rarely used, except for spawning (Hauser 1969; Wydoski and Wydoski 2002).

Mountain suckers are benthic feeders. Their diet consists mainly of simple plants like diatoms, green algae, and blue-green algae, but small invertebrate animals are also ingested. They are considered spring spawners, but the exact timing varies across the geographic range—probably in response to local variations in water temperature

The wide distribution and high abundance of mountain suckers at many sites in the Black Hills, even after more than a century of intensive land use, suggests that current risks for this species are minimal (Isaak et al 2002). Therefore, land use activities and impacts to stream habitats would have to deviate strongly and on a forest-wide scale from historic and current norms before mountain sucker populations would be jeopardized (Isaak et al 2002). The South Dakota Natural Heritage Database now tracks the mountain sucker. It is ranked S3 (*either very rare and local throughout its range in the state, or found locally in a restricted range in the state, or vulnerable to extinction throughout its range in the state because of other factors*) (Erickson 2002).

Of the streams surveyed within the project area in 1997, 1998 and 2000, mountain sucker were found in Bear Butte Creek, Elk Creek, Meadow Creek, Strawberry Creek and Whitewood Creek. Table 93 below shows the streams surveyed and average population of Mountain Sucker where they occurred in these streams.

Table 37 Average Mountain Sucker Populations

Stream	Year	# of Sites Surveyed	# of Sites with Mt. Sucker	Average # of Mt. Sucker per Acre
Bear Butte Creek	1997	3	3	1572
	2000	7	7	1017
Elk Creek	1997	2	2	3059
Hay Creek	2000	1	0	NA
Meadow Creek	1998	1	1	1205
Strawberry Creek	1998	1	0	NA
	2000	2	1	134
Two Bit Creek	1997	1	0	NA
	1998	3	0	NA
Two Bit Creek W Fork	1997	1	0	NA
Whitewood Creek	1997	2	1	124
	1998	3	3	762

Brown Trout

Brown trout are an important game species, which are not native to the Black Hills (Black Hills of South Dakota Fishing Guide 2000). They are widely stocked but also reproduce naturally. They prefer clear, cold stream headwaters and lakes, although they can survive in deeper, warmer, slower waters than other trout. Temperatures of 22□-28□C are lethal and non-turbid waters are required for egg survival. Management

practices with adverse effects include reduction of shade over water, channelization and sedimentation (Biota Information System of Mexico).

Of the streams surveyed within the project area in 1997, 1998 and 2000 Brown trout were found in Elk Creek and Whitewood Creek. Table 94 below shows the streams surveyed and the average population of Brown trout where they occurred in these streams.

Table 38 Average Brown Trout Populations

Stream	Year	# of Sites Surveyed	# of Sites with Brown Trout	Average # of Brown Trout per Acre
Bear Butte Creek	1997	3	0	NA
	2000	7	0	NA
Elk Creek	1997	2	2	68
Hay Creek	2000	1	0	NA
Meadow Creek	1998	1	0	NA
Strawberry Creek	1998	1	0	NA
	2000	2	0	NA
Two Bit Creek	1997	1	0	NA
	1998	3	0	NA
Two Bit Creek W Fork	1997	1	0	NA
Whitewood Creek	1997	2	2	818
	1998	3	3	335

Brook Trout

Brook trout are an important game species introduced to the Black Hills (Black Hills of South Dakota Fishing Guide 2000). They need cold, clean headwater streams and lakes. They are sensitive to water temperatures above 20□C for extended periods of time and degraded water quality including low pH, low dissolved oxygen, and sedimentation. Brook trout spawn on gravel and cobble. The eggs are susceptible to mortality from sediment. Management activities that cause changes in brook trout habitat include livestock grazing in riparian zones, channelization and sediment from roads and other ground-disturbing activities (Biota Information System of New Mexico).

Of the streams surveyed within the project area in 1997, 1998 and 2000, brook trout were found in Bear Butte Creek, Elk Creek, Hay Creek, Meadow Creek, Strawberry Creek Two Bit Creek, Two Bit Creek West Fork, and Whitewood Creek. Table 95 below shows the streams surveyed and the average population of brook trout where they occurred in these streams.

Table 39 Average Brook Trout Populations

Stream	Year	# of Sites Surveyed	# of Sites with Brook Trout	Average # of Brook Trout per Acre
Bear Butte Creek	1997	3	3	108
	2000	7	7	795
Elk Creek	1997	2	2	1779
Hay Creek	2000	1	1	828
Meadow Creek	1998	1	1	308

Stream	Year	# of Sites Surveyed	# of Sites with Brook Trout	Average # of Brook Trout per Acre
Strawberry Creek	1998	1	0	NA
	2000	2	2	1076
Two Bit Creek	1997	1	1	4731
	1998	3	1	5544
Two Bit Creek W Fork	1997	1	1	3804
Whitewood Creek	1997	2	2	51
	1998	3	3	21

Proposed, Endangered, Threatened and Sensitive Species (PETS)

The Black Hills National Forest maintains lists of species that require special consideration during project planning. All PET species (USFWS designated) and those that occur on the 2003 Regional Forester's Sensitive Species list were considered during the initial evaluation of the Proposed Project. There are no Proposed, Threatened, Endangered, or Sensitive aquatic species within the project area or its influence.

Environmental Consequences:

Analysis of MIS Effects

Brook trout, brown trout, mountain sucker and Instream Fisheries Habitat are all similarly affected by the proposed activities, therefore, effects presented below apply to all fisheries resources within the project area. There is no habitat suitable for either finescale dace or lake chub within the project area nor has their presence been indicated by surveys.

Instream Fisheries Habitat

Instream fisheries habitat includes those factors associated with the biological, physical and chemical environment of a stream that affect both quality and quantity of fisheries habitat. Such factors include water temperature, pH, total dissolved solids, total suspended solids, sediment, bank stability, ground cover, streambed type and others. Factors relevant to this project are analyzed in both the hydrology section of the EIS, and the following fisheries effects analysis.

Direct and Indirect Effects

Alternative 1 – No Action

The No Action alternative will have no direct effects on fisheries resources. Indirect effects would occur because existing roads would continue to contribute erosion at the current rate. No new roads would be built, but no existing roads would be decommissioned.

Alternatives 2, 3 & 4

Timber harvest, bait and sanitation cutting, and non-commercial thinning will have no direct effects on fisheries. None of these activities will occur within stream channels, and riparian corridors will be protected through the implementation of mitigation measures (See Appendix B). Although water yields may increase, they are not expected to be significant. Refer to the Stream Flow Regime discussion in the Hydrology section for a description of potential water yield changes.

Prescribed burns will occur over a portion of the watershed but will have no direct effects on fisheries. Indirect effects will vary due to fire intensity, aspect and slope, and all burns remove some degree of forest floor cover. Exposure of bare mineral soil may occur during prescribed burns but is not a common occurrence and is rarely extensive in area. Prescribed fire will also occur in riparian corridors as fire backs to the edge of streams used as firelines, but these fires are rarely intense and typically top-kill only the smallest streamside vegetation because of the high humidity near watercourses. The reduction in leaf litter and herbaceous plants and plant remains may result in the potential for increased sedimentation and enhanced nutrient content of river water. Water yield will likely increase slightly due to reduced transpiration and raindrop interception by herbaceous plants.

Construction of prescribed burn fuel breaks will have no direct effects on fisheries. Indirect effects include removal of vegetative cover and exposure of minerals soil that will result in increased erosion and possible sedimentation of streams. The placement of fireline water control structures (water bars) will reduce the velocity of water moving along firelines and encourage the sediment load to be dropped before reaching streams. In addition, the construction of turnouts at the end of water bars that terminate in leaf litter outside the burn area also helps filter runoff and reduces the potential degradation of water quality. Fuel breaks constructed within riparian or buffer zones that result in reduction of forest canopy can reduce shade and affect stream temperature, cover, primary production and habitat (Belt et al 1992). Bank erosion and lateral channel migration can also contribute sediments if protection vegetation and living root systems are removed. Summer stream temperature increases due to the removal of riparian vegetation has been well documented (Belt et al 1992). Measurements by Hewlett and Fortson (1983) under winter conditions also indicate that removal of riparian vegetation can reduce temperatures by about 10°C. Effects to stream temperature can be reduced by retaining a large portion of the shade-providing trees within the buffer zone.

Construction of temporary roads, skid trails and log landings will have no direct effects on fisheries. Indirect effects will include the removal of vegetative cover and soil disturbance as these areas are established, shaped and drainage structures installed. These activities have the potential to increase sedimentation, concentrate runoff, and possibly alter surface and subsurface flow and potentially impact water quality. The potential for sedimentation will be reduced by surfacing these roads with gravel, re-vegetating exposed soils outside the needed roadbed, establishing sedimentation traps in drains leading to streams and not establishing roads within streamside corridors. Road closures would have beneficial effects on the fisheries by increasing the streamside vegetation and streambank stability and decreasing sediment transport.

Fisheries resources within the project area are dependent upon high water quality levels and low levels of siltation. Forest Plan standards and guides and Best Management Practices that have established specific protective buffer zones for streams will provide protection for these species' habitat during timber harvest, associated silvicultural activities, and prescribed fire (see Appendix B). The construction of temporary roads and skid trails may have a temporary impact immediately downstream from crossings by silting in egg masses during the rearing season. However, this effect may be mitigated by the use of large cobble rocks at stream crossings which hold up well under traffic, prevent muddying of the water and serves as suitable substrate for juveniles and hatchlings to hide in after the timber sale has closed. In the event more permanent structures are needed, preference would be given to low water concrete slabs and open box culverts, properly installed.

Potential supplies of sediment are a function of the number of miles of roads and the predominant surface type within 300 ft of streams, the amounts of road proposed for decommissioning and construction, and the amount of prescribed burning proposed by alternative and the access of material to the stream. Alternative 3 has the highest potential for associated erosion issues and Alternative 2 has the least. Effects due to sedimentation and vegetation disturbance associated with harvest are expected to be minimal through the application of BMP's, Forestwide Standard and Guides for Soil, Water, and Riparian zones. (See Appendix B).

Cumulative Effects

Alternative 1 – No Action

The No Action alternative will have no cumulative effects on fisheries.

Alternatives 2, 3, & 4

Cumulative effects will include the incremental increase in indirect effects as additional units are harvested during the timber harvest contract period, typically 3 years total.

However, as units are harvested in the second year, those units harvested the first year will have already begun recovery of forest floor vegetation and ground litter from cast leaves and needles. This overlapping process of loss and recovery of ground cover and forest floor vegetation between years will continue post harvest.

Cumulative effects of additional water yield on water quality due to timber harvest and prescribed burning will be short lived. A flush of herbaceous ground cover occurs due to increased sunlight levels. Associated transpiration rates and rain interception surfaces will also increase.

Impacts on water quality and yield from prescribed fire activity will not be additive to those impacts from timber harvest because they will occur as temporally separate events. If there are effects on water quality from prescribed fire it will be temporally distinct, occurring after timber harvest sites have begun recovery through vegetative re-growth. The effects of sequential prescribed burns within the watershed will depend upon their locations and distances from intermittent and perennial streams, but overlap of indirect effects (incremental increases) will probably occur. As with timber harvest, the first areas of prescribed burning will have begun vegetative recovery before subsequent areas are burned, with effects on water quality expected to last only for one to two growing seasons after the last burn has been achieved. Long-term effects on mountain sucker or its habitat beyond the life of the current action are not anticipated because of swift terrestrial vegetative recovery and natural flushing of stream systems through normal rain events.

Potential cumulative effects of firelines on water quality with regard to fisheries will be greatly reduced due to mitigation measures in place, and revegetation of firelines following burns. Indirect effects of fireline construction on water quality may be additive with respect to subsequent fireline construction and burns. This will depend upon location of burns and associated firelines, quality of fireline and water bar construction, rate of re-vegetation and accumulation of leaf litter. Indirect effects of fireline construction will not be additive to timber harvest that will have recovered prior to fireline construction and burning. Because firelines are often located on slopes and involve exposure of mineral soil, they have the potential for long-term effects on water quality. Mountain sucker and its habitat may be affected if firelines are improperly constructed. These effects may occur within the watershed and downstream.

The cumulative effects of construction of temporary roads, skid trails and log landings should be minimal since the total acreage of disturbance is small for roads and a few additional acres for skid trails and landings. Most of these areas will be closed at project conclusion. Unlike firelines, the potential for long-term effects on water quality and fisheries habitat are not anticipated

Cumulative Activities

Past, Present and Reasonably Foreseeable Future Actions

Past Actions

Past actions in the project area on National Forest, private, and other lands include timber harvest, wildland fuel management, fire suppression, grazing, mining, gravel production, recreation, firewood cutting, big-game management, road construction, railroad construction, subdivision of private lands and home construction, utility line construction and maintenance.

Boomer Timber Sale EA 2000

The acres treated are estimated at 600-700 acres. The treatments included shelterwood prep cuts, seed cuts and overstory removal. Commercial thinning, POL thinning and group selection treatments were also done. Some areas received special cuts that removed the pine to enhance hardwood stands. This project included Strawberry Creek and Bear Butte Creek, which are also found within or adjacent to the Elk Bugs and Fuel project area.

Grizzly Gulch Fire

The Grizzly Gulch Fire of June and July of 2002 burned 11,589 acres of which 3,315 are National Forest. Almost half of this fire, 5,608 acres, burned within the Elk Bugs and Fuel project boundary; 3,025 acres of National Forest lands and 2,583 acres of other ownership. National Forest lands within the project area that burned were mostly forest vegetation, with ponderosa pine, aspen, or aspen-birch cover types. Vegetation mortality followed levels of fire severity. Mortality of trees on National Forest lands within the project area was mostly low to moderate, with high mortality, greater than 60%, on approximately 240 acres (Garbish, B 2002). Areas of high mortally were pine stands on steep, rugged slopes with little or no past treatment. No commercial timber salvage is planned on National Forest lands. Salvage is occurring on BLM managed lands and private lands.

Present Actions

Peak EA timber harvests and related treatments, 2002

This project includes commercial treatments of 1151 acres and restoration treatments on 460 acres. Wildlife habitat improvements will take place on 164 acres. This project includes Whitewood Creek and its tributaries, which is also within or downstream from the Elk Bugs and Fuel project area.

Grizzly Gulch Fire-Salvage and Hazard Tree Removal- 2002-ongoing

This is a BLM Project to remove dead trees killed in the 2002 Grizzly Gulch Fire. This is occurring on BLM lands adjacent to main road up Spruce Gulch to top of ridge, estimated 5 miles, and harvesting dead trees within reach of the road or within tractor slope. Acres salvaged are estimated at 300-600 acres.

Future Actions

BLM Wildland-Urban Interface Project, 2003

This project will include Whitewood Creek and its tributaries, which is also within or downstream from the Elk Bugs and Fuel project area.

Mineral EA, 2003

This project will occur directly adjacent to the southwest side of the Elk Bugs and Fuel project area. Both the Mineral project and the Elk Bugs and Fuel project will impact Whitewood Creek and Bear Butte Creek and its tributaries. No impacts to fisheries are expected to occur in this project as long as BMP's and mitigation measures are followed.

Legislated Activities

Legislated activities within the project area include non-commercial treatments in the Forbes Gulch area and fuel breaks along the boundaries inside of Beaver Park. Approximately 3,372 acres of activities would occur outside of the project boundary.

Legislated activities within the project area include non-commercial treatments in the Forbes Gulch area and fuel breaks along the boundaries inside of Beaver Park. Approximately 3,372 acres of activities would occur outside of the project boundary.

Effects from the Cumulative Activities

The majority of land within this watershed is federal land managed by the U.S. Forest Service. Resource management emphases (forest management) on these adjacent lands administered by the U.S. Forest Service are unlikely to change, and will continue to offer plants and animals a variety of forest types, successional stages, and structural diversity in virtual perpetuity. The U.S. Forest Service has no control over those lands managed by

state, local, other federal agencies, or private landowners. It is likely that some ground disturbing activities will take place on these lands in the future. Some of these activities have the potential to impact some species in a positive or negative manner, particularly if those activities affect water quality.

Cumulative effects from ongoing activities on lands managed by the Forest Service are expected to be minimal due to the implementation of the Forest Standards and Guidelines, Region 2 Water Conservation Practices, and South Dakota Best Management Practices.

Determination of Effects and Rational

The rationale for the following determination was set forth in the individual species account.

Mountain sucker: The Proposed Project "may impact individuals but is not likely to cause a trend to federal listing or a loss of viability."

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable commitments of fisheries resources would occur with implementation of any action alternative.

Management Requirements

Construct roads and other disturbed sites to avoid sediment discharge into streams and wetlands.

Keep heavy equipment out of streams, swales, and lakes and their tributaries except to cross at designated points to avoid adding sediment.

Route road drainages through the streamside management zone (SMZ), filtration fields, or other settlement settling structures to trap sediment and prevent its entry into a stream.

Sensitive Plants

Affected Environment:

The majority of the project area is forested with a ponderosa pine (*Pinus ponderosa)* over-story. Ponderosa pine dominates the ridge tops and xeric slopes. The xeric ponderosa pine dominated areas are not habitat for R2 Sensitive plants and most species of Interest (some are found on limestone cliffs among dry pine types, not areas planned for treatment). Most stands have been managed in the past by thinning and regeneration cutting. Paper birch (*Betula papyrifera*), ironwood (*Ostrya virginiana*), aspen (*Populus tremuloides*), and Black Hills spruce (*Picea glauca*) are found in the moister areas, often between meadow and upland forest types, along small drainages, and along eastern and northern aspects as co-dominant species or occur locally within another plant community type. Meadows, riparian vegetation, and mined-over lands are also present within the project boundary. Using the habitat type classification presented in *The Nature Conservancy's- Black Hills Community Inventory (Marriott 2000*) the plant community types for the Elk Bugs and Fuels project area would include:

Upland Forests and Woodlands –*Pinus ponderosa/Juniperus communis; Pinus ponderosa/Symphoricarpos; Pinus ponderosa/Mahonia repens:* and some *Pinus ponderosa/Prunus virginiana* and *Pinus ponderosa/Quercus macrocarpa* along the eastern portions of the project area.

Upland shrubs- *Juniperus horizontalis/Schizachrium scoparium (lower Vanocker creek area).*

Sparse Vegetation Plant Community – *Pinus ponderosa*/Limestone Cliff Sparse Vegetation.

Riparian/Wetland Communities – *Salix exigua* Temporarily Flooded Shrubland; *Symphoricarpos occidentalis* Shrubland; *Betula papyrifera/Corylus cornuta* Forest; *Salix bebbiana* Shrubland; and *Glyceria grandis/Poa palustris* Mixed Herbaceous Black Hills Herbaceous Vegetation.

The geomorphic Central Core, Limestone Plateau, and elements of the Minnelusa (Minnekahta limestone) Foothill geomorphic regions are represented within the Elk Bugs and Fuels Project area (Larson 1999). Topography of the project area varies from steep rugged terrain (rim rock and rocky outcrops), to gentle rolling hills. The varied geomorphology of the project area create small areas (less than 5 acres) of mixed

community types and areas that may be classified as additional types if they were larger in size. These areas are difficult to classify and are not listed due to limited size, distribution, and importance across the project area.

Several perennial creeks flow from the project area including Elk creek, Vanocker creek, Beaver gulch, Tilford gulch, Forbes gulch, Bulldog gulch, Alkali creek, Deadman gulch, Bear Butte creek, and Boulder creek. Other named and unnamed creeks and springs are located throughout the project area. Many of these creeks support wet meadows, riparian vegetation, and plant communities with paper birch/aspen/Black Hills spruce dominant or present.

All species that could be reasonably expected to occur in the Elk Bugs and Fuels Project area can be found in Section II of the Biological Evaluation for R2 Sensitive plants. For the species specific 'Risk Assessment' refer to Appendix C of the Biological Evaluation located in Section C.2.5 of the Project File.

Information about the status of plants in the project area was derived from historic plant occurrence information (pre-2002) and field information gathered in 2002. Surveys for R2 Sensitive plants and plant Species of Interest in 2002 were limited to suitable habitats. Rainfall in 2002 was below average, resulting in plants drying up earlier in the season than usual. The dry year coupled with later than usual surveying created a situation where only high probability habitats could be confidently identified. Approximately 3,800 acres of occupied or field verified suitable high probability R2 Sensitive/Species of Interest plant habitats have been identified near areas of proposed actions (field verified from the Arcview Hillshade command mapping indication of likely Sensitive plant habitat areas). Habitats encountered during survey include a few Habitats of Interest such as springs, seeps, and one unverified unusual occurrence of lodgepole pine (*Pinus contorta*). Those habitats have been included in the GIS mapping exercise for areas to avoid during planning for the Elk Bugs and Fuels Project. All of the 3,800 acres are outside of any proposed actions in all alternatives of the Elk Bugs and Fuels Project.

Sensitive Plant Occurrences in the Project Area:

No U.S. Fish and Wildlife Service (USFWS) Federally listed plant species occur in the Black Hills. Of the eleven R2 Sensitive species with high probability habitat in the project area, seven species were found within the project area. The seven R2 Sensitive plant species with occurrences in the Elk Bugs and Fuels Project area are the American trailplant/pathfinder (*Adenocaulon bicolor*), northern arnica (*Arnica lonchophylla*), long-stalk sedge (*Carex pedunculata*), treelike clubmoss (*Lycopodium dendroideum*), marsh muhly (*Muhlenbergia glomerata*), and bloodroot *(Sanguinaria canadensis*). All of these species are found in moist forest habitats.

Table 40 Black Hills National Forest (BHNF) R2 Sensitive Plant Species

Code	Scientific name	Common Name	SD State Rank	WY State Rank	Global Rank	Black Hills habitat
ADBI	*Adenocaulon bicolor**	American trailplant	S2	S1	G5?	Moist shaded forests with a hardwood component. Often in aspen/hazelnut and birch/hazelnut woods, on north-facing slopes and in small drainages. Elevation range 3,940-6,200 feet.
ARLO5	*Arnica lonchophylla**	Northern arnica	SU	S1	G4?	Located in dry to moist partially shaded conifer, hardwood and mixed stands. Elevation range 3,700-6,300 feet.
CAPE4	*Carex pedunculata**	Long-stalk sedge	S2	NA	G5	Typically found on rich loamy soil on north, east, and west -facing slopes, terraces and stream banks. Prefers moist deciduous/conifer forests. Elevation range 3,800-6,100 feet.
EQSC	*Equisetum scirpoides*	Dwarf scouring-rush	S2	S1	G5	Shaded, damp habitats along streams and on terraces in white spruce and birch woods. Elevation range 4,150-5,500 feet.
LYCO3	*Lycopodium complanatum**	Trailing clubmoss	S1	S1	G5	Found on shaded, north facing slopes in white spruce/paper birch forest, often in moist side drainages. Elevation range 5,000-5,820 feet.
LYDE	*Lycopodium dendroideum**	Treelike clubmoss	S2	S1	G5	Typically found in moist, north-facing slopes, side drainages and ravines. Associated with spruce and hardwoods. Elevation range 4,100-5,540 feet.

Code	Scientific name	Common Name	SD State Rank	WY State Rank	Global Rank	Black Hills habitat
MUGL3	*Muhlenbergia glomerata**	Marsh muhly	SU	S1	G4	Habitats range from pine and spruce dominated open forest with a hardwood component to ledges and slopes along creeks; and open, grassy hardwood draw bottoms. Elevation range 4,160-6,000 feet.
PLOR4	*Platanthera orbiculata*	Large round-leaf orchid	S1	S1	G5?	Found on shady, north-facing slopes in birch/hardwood stands, and occasionally in conifer forests on damp, rich, humus soil. Elevation range 4,350-6,150 feet.
SASE2	*Salix serissima*	Autumn willow	S1	S1	G4	Fens and wet meadows. Known from McIntosh fen and along the Middle Fork of Boxelder Creek
SACA13	*Sanguinaria canadensis**	Bloodroot	S4	NA	G5	Typically found on floodplains, terraces, and north facing slopes of rich deciduous forests in leaf litter and loamy soil, occasionally coniferous forests. Elevation range 3,940-5,000 feet.
SCCY	*Scirpus cyperinus*	Cottongrass bulrush	S2	S1	G5	Moist to saturated soils of forested stream banks and wetlands. Elevation range 4,200-5,600 feet.

* Known within the project area.

Only R2 listed species with suitable habitat in the project area were analyzed in the Biological evaluation for the Elk Bugs and Fuels Project.

Another R2 Sensitive species, *Corallorhiza odontorhiza,* has not been documented in the Black Hills since 1971 (Lawrence County, South Dakota). An exact location has not been determined from the 1971 record and has not been successfully relocated to date (Ode pers. comm. 2000 as cited in USDA 2001). Despite surveys in the vicinity of the previous record in 2001 and surveys in other areas of the Black Hills for the species, *Corallorhiza odontorhiza* has not been found again. Although surveys are ongoing,

Corallorhiza odontorhiza is currently not considered to be present in the Black Hills and is not evaluated in the risk assessment of the Biological Evaluation.

Other Species of Interest:

In addition to consideration of USFWS Federally listed and R2 Sensitive plant species, twenty-eight Species of Interest have been identified as present within the project area. These species appear on BHNF Species of Interest list (which includes plants that need more information about status, biology, and distribution), the State of South Dakota Department of Game, Fish, and Parks Natural Heritage Program list of Rare, Threatened, and Endangered Plants dated April 30, 2002 (SDDGFP List). The SDDGFP List includes plants that are rare and tracked in South Dakota. The table of plant Species of Interest represents the portion of the BHNF and SDDGFP lists having known occurrences in the Elk Bugs and Fuels Project area.

Table 41 BHNF Northern Zone Plant Species of Interest in the Project Area

Species	Plant Code	Global Ranking	SD State Ranking*
Asplenium trichomanes-ramosum	ASTR10	G5	S3
*Aquilegia brevistyla***	AQBR	G5	SR
Botrychium multifidum	BOMU	G5	S1
Botrychium virginianum	BOVI	G5	-

Corallorhiza trifida	COTR3	G5	S2
*Carex eburna***	CAEB2	G5	-
Carex granularis var. *haleana***	CAGRH	G5/T4	SR
Cypripedium parviflorum var. *pubescens*	CYPA19	G5	S3?
Cynoglossum virginianum var. *boreale*	CYVIB	G5T4T5	-
Disporum hookeri (var. *oreganum*)	DIHO3	G5 (G5T4T5)	-
Elymus diversiglumis (E. interruptus)	ELDI	G5	-
*Elymus villosus***	ELVI	G5	SR
Gymnocarpium dryopteris	GYDR	G5	-
Luzula acuminata var. *acuminata***	LUACA	G5/T4/T5	SU
Luzula parviflora	LUPA	G5	SU
Melica subulata	MESU	G5	S3
Moneses uniflora	MOUN2	G5	-
Orobanche uniflora	ORUN	G5	SU
*Pellaea gastonyi***	PEGA5	G2G4	SR
Petrophyton caespitosum	PECA12	G4	S4?
Phleum alpinum	PHAL2	G5	SU
Pinus contorta? (var. *latifolia*?)****	PICO	G5	-
*Polystichum lonchitis***	POLO4	G5	S1
Pyrola picta	PYPI2	G4G5	S2
Sorbus scopulina	SOSC2	G5	S4
*Vaccinium membranaceum***	VAME	G5Q	S2
Viburnum lentago	VILE	G5	-
Viburnum opulus var. *americanum***	VIOPA2	G5T5	SR

*Note: Some species may also be found on the Wyoming State Lists.
**On the BHNF Species of Interest list.
*** Identification not confirmed.

Environmental Consequences:

Studies of R2 Sensitive and Species of Interest plants and their habitats have not occurred. As a result, little about effects to these plants from disturbances are known. A conservative approach to avoid direct impacts to R2 Sensitive and Species of Interest plants and high probability habitats has been developed for this project. Indirect effects for the project are described by alternative, however it is generally assumed indirect effects from the proposed project are negative to R2 Sensitive and Species of Interest plants and their habitats unless treatments were specifically designed to benefit these

species. These include the effects from noxious weed introduction and spread, soil movement, and increased livestock access to their habitats.

There are eleven species of R2 Sensitive plants with high probability habitat in the project area. Seven of those species (*Adenocaulon bicolor*, *Arnica lonchophylla*, *Carex pedunculata*, *Lycopodium dendroideum*, *Muhlenbergia glomerata*, and *Sanguinaria canadensis*) have known occurrences within the Elk Bugs and Fuels Project area. Within the project area, twenty-eight other Species of Interest (*Agrimonia gryposepala*, *Asplenium trichomanes-ramosum, Aquilegia brevistyla, Botrychium multifidum, Botrychium virginianum, Corallorhiza trifida, Carex eburna, Carex granularis* var. *haleana, Cypripedium parviflorum* var. *pubescens, Cynoglossum virginianum* var. *boreale, Disporum hookeri, Elymus diversiglumis (E. interruptus), Elymus villosus, Gymnocarpium dryopteris, Luzula acuminata* var. *acuminata, Luzula parviflora, Melica subulata, Moneses uniflora, Orobanche uniflora, Pellaea gastonyi, Petrophyton caespitosum, Phleum alpinum, Pinus contorta, Polystichum lonchitis, Pyrola picta, Sorbus scopulina, Vaccinium membranaceum, Viburnum lentago,* and *Viburnum opulus* var. *americanum*) have known occurrences. Additional unknown occurrences may be present within the project area because only those areas proposed for treatments under the Elk Bugs and Fuels Project were surveyed for R2 Sensitive plants and suitable habitats in 2002. Approximately 3,800 acres of occupied R2 Sensitive plant and Species of Interest, and high probability habitats for these species have been identified near the proposed action areas. It is not likely that R2 Sensitive and Species of Interest plants occupy all 3,800 acres. However, all of these areas will be avoided during implementation of the Elk Bugs and Fuels Project.

Direct Effects Common to all Alternatives:

In the no action alternative, no direct effects to sensitive plant species are expected since ground disturbing activities are not proposed. In all action alternatives, known plant occurrences and high probability habitat for R2 Sensitive plant species and Species of Interest would be avoided during project implementation. Development of implementation maps from the current GIS layers for each emphasis area (transportation, wildlife, fuels, timber, etc.) would have areas to avoid and areas where on-site botany personnel are required during project implementation (for example where new roads are proposed close to protected high probability habitat areas). No direct effects are expected from any of the alternatives in the Elk Bugs and Fuels Project.

Indirect Effects from the No Action Alternative (Alternative 1):

Indirect effects from the no action alternative include long-range effects from wildfire in areas of untreated fuels accumulations. The R2 Sensitive plants, Species of Interest, and high probability habitats are generally more mesic portions of the landscape and historically do not burn as intensely as other areas. However without treatment of fuels, creation of fuel breaks, and the removal of bug-killed trees, fires in the future would

likely be more intense and more widespread. The effects from a wildfire can be expected to be greater than if fuels reduction activities had not taken place. These effects could include the reduction of canopy closure (which could be beneficial in pine types, and would be detrimental in hardwood types), short-term increases of erosion and available nutrients, increases in competing early seral vegetation, increases in livestock access, and increase of the risk of spread and introduction of noxious weeds. These effects could impact R2 Sensitive plants, Species of Interest and high probability habitats.

Indirect Effects common to all Action Alternatives (2, 3, and 4):

In all of the action alternatives, short-term increases in risks from the introduction and spread of noxious weeds from equipment used during implementation of the project as well as reductions of soil cover can be expected. Reductions of soil cover increases the risk that weeds can be introduced and become established (Petroff 1999). Noxious weed infestations are a particular threat to R2 Sensitive plants, Species of Interest, and suitable habitats. Mitigations to prevent the introduction and spread of noxious weeds into the proposed treatment areas have been built into the project (including avoiding known infestations during project implementation and requiring equipment that operates off road be free from weeds and soil before coming to the project area) and will reduce the risk of negative indirect effects from noxious weeds on the R2 Sensitive plants and Species of Interest. Indirect effects from soil movement as a result of these activities are possible, but are expected to be of short duration (i.e. less than 5 years). Movement of soil into occupied R2 Sensitive plant and Species of Interest occurrences and their habitats could affect them indirectly by changing their habitat. The effect of soil movement into R2 Sensitive plant and Species of Interest occurrences and high probability habitats could range from smothering and killing individuals to adding additional nutrients that could be either positive or negative indirect effects (additional nutrients may increase competition from other species, or the additional nutrients may be beneficial). Removal of vegetation and trees in the fuels and silvicultural proposals would increase access for livestock across the project area. The effects from grazing and trampling of the R2 Sensitive plants and high probability habitats would be a negative indirect effect. Once the cattle have access to an area, repeated use could perpetuate the access and effects. These effects generally would be limited in scope and duration (small areas and less than 5 years or the duration of project implementation), but could affect individuals in the R2 Sensitive plant occurrences. Generally these effects are assumed by botanists to be negative effects.

Indirect Effects from Alternative 2

In this alternative, additional fuel breaks not surveyed in 2002 have been proposed. The importance of the fuel break treatment was developed too late in the project process to perform field surveys for botany. These additional treatments (from the proposed treatment areas developed during 2002) add approximately 737 acres. The areas within the additional proposed fuel break areas that are high probability R2 Sensitive plant and

Species of Interest habitats would be surveyed prior to project implementation. Based on GIS mapping, approximately 107 acres of the additional proposed fuel break acres are mapped as high probability habitat and would be surveyed prior to project implementation. From past experience, areas outside of the 107 acres may become botany avoidance areas and some of the 107 acres may become available for treatments after field verification. Any R2 Sensitive and Species of Interest plants and high probability habitats located in the additional fuel break areas will be avoided.

Indirect Effects from Alternative 3

This alternative was developed emphasizing benefits to wildlife species. In general, treatments would be less intense or over fewer acres than the Modified Proposed Action (Alternative 2). As a result the expected indirect effects to R2 Sensitive plants, Species of Interest, and high probability plant habitats would be less than Alternative 2. As a part of Alternative 3, conifer (pine) removal and prescribed burning is proposed in and around meadows, which is expected to increase grass, forb, and shrub habitats preferred by wildlife. All of these areas are outside of R2 Sensitive plant and Species of Interest occurrences and high probability habitats. Removal of pine from the meadows could benefit R2 Sensitive plant species and Species of Interest by maintaining meadow/forest edge habitats by maintaining mesic habitat types. Indirect effects from soil movement as a result of these activities are possible, but expected to be of short durations (less than 5 years) and limited in scale.

Indirect Effects from Alternative 4

This alternative was developed to provide additional wildfire control in the urban interface areas. Four roads totaling 4.8 miles that are proposed for decommissioning in Alternatives 2 and 3 would not be decommissioned under this alternative. Removal of roads often has a short-term increase of soil movement, but a long-term benefit to ecosystems by reducing access areas for noxious weed vectors, reducing sediment movement in the long-term, and reducing the effects from hydrologic changes which can negatively effect R2 Sensitive plants, Species of Interest, and suitable habitats. Additionally fuels treatments are proposed within a 200-foot radius survivable space zone around structures and a ½ mile radius wild-land/urban-interface zone of reduced fuels around all the inhabited structures in the project area. These treatments would be outside of all R2 Sensitive plants and Species of Interest occurrences and high probability habitats for these species. For these treatments to be effective, tree and vegetation removal would be greater than the treatments proposed to reduce the risk of pine beetle spread. Soil movement, risk of noxious weed introduction and spread, and access for livestock increases over Alternative 2 would be expected. As a result an increase of indirect effects to R2 Sensitive plants and Species of Interest and high probability habitats over Alternative 2 would be expected.

Cumulative Effects (Common to all Action Alternatives):

Planned projects to reduce fuels, reduce the risk/spread of pine beetle outbreaks, improve wildlife habitat, and improve firefighting conditions by creating fuel breaks are adjacent to the Elk Bugs and Fuels Project. Other projects in the Northern Black Hills such as the adjacent Mineral Forest Management Project have botany mitigations similar to the Elk Bugs and Fuels Project to prevent direct effects. Indirect effects from these projects are also expected to be similar to those described in the Elk Bugs and Fuels Project.

Adjacent to the Elk Bugs and Fuels project area are areas legislated by the United States Congress to treat for fuels. Previously known occurrences of R2 Sensitive plants and Species of Interest would be avoided during implementation of the treatments for the legislated areas. Other than avoiding previously known occurrences, these legislated areas are exempt from further botanical consideration and would likely have direct, indirect, and contribute to cumulative effects to R2 Sensitive plants, Species of Interest, and high probability habitats. In addition to the seven known R2 Sensitive plants and 30 Species of Interest present in the project area, occurrences of the R2 Sensitive species *Equisetum scirpoides* and the Species of Interest *Carex leptalea* and *Selaginella rupestris* are adjacent to the project area and are within the legislated treatment area (these occurrences would be avoided during project implementation). No new surveys for R2 Sensitive plants or high probability habitats would be performed for the legislated project areas. As a result, other occurrences in unsurveyed areas in the legislated project area may go undetected during project implementation and effects to those occurrences could include direct effects from driving on plants, burning plants, and removing suitable habitat for these species. The indirect effects could include changes in light regime by over story removal, soil movement on to occurrences (no buffers would exist like the Elk Bugs and Fuels and Mineral Forest Management Projects), changes to hydrology, increased access for livestock, and the introduction and spread of noxious weeds.

Efforts to prevent direct effects and limit indirect effects to R2 Sensitive plants Species of Interest and high probability habitats have been made in the design of the Elk Bugs and Fuels Project. This included developing the GIS layer used in the planning process that has approximately 3,800 acres of areas that were avoided during project design for all alternatives. Mitigations to prevent direct effects and reduce indirect effects include having a botanist present during on-the-ground road layout where new roads are planned near R2 Sensitive plants, Species of Interest, and high probability habitats, requiring equipment that operates off road be free from weeds, and surveying the additional fuel break areas for R2 Sensitive plants, Species of Interest, and suitable habitats prior to implementation and avoiding any R2 Sensitive plant and Species of Interest occurrences, and high probability habitats found during those surveys. For a complete and site-specific list of mitigations please refer to the Mitigations and Recommendations section of the Biological Evaluation located in Section C.2.5 of the Project File. Also see Appendix B of the DEIS.

Direct and Indirect Effects R2 Sensitive Plant Species With Suitable Habitat in the Project Area and No Known Occurrences:

The four R2 Sensitive species that have suitable habitat in the project area (*Equisetum scirpoides, Platanthera orbiculata, Salix serissima, Scirpus cyperinus*) may be present in areas that were not surveyed as a part of the 2002 surveys or are in the areas identified as high probability habitat. Occurrences of the seven R2 Sensitive species known to be in the project area also may have additional occurrences in areas that were not surveyed as a part of the 2002 surveys of proposed project areas or are in the areas identified as high probability habitat. No direct effects are expected as a result of implementation of this project. Off site indirect effects could be possible from noxious weed introduction, soil movement, and increased livestock access.

Conclusion:

Due to potential indirect and cumulative effects from the Elk Bugs and Fuels Project on R2 Sensitive plants the seven sensitive species present in the project area, (American trailplant/pathfinder (*Adenocaulon bicolor*), northern arnica (*Arnica lonchophylla*), long-stalk sedge (*Carex pedunculata*), treelike clubmoss (*Lycopodium dendroideum*), marsh muhly (*Muhlenbergia glomerata*), and bloodroot *(Sanguinaria canadensis*), and the twenty-eight Species of Interest *Agrimonia gryposepala*, *Asplenium trichomanes-ramosum, Aquilegia brevistyla, Botrychium multifidum, Botrychium virginianum, Corallorhiza trifida, Carex eburna, Carex granularis* var. *haleana, Cypripedium parviflorum* var. *pubescens, Cynoglossum virginianum* var. *boreale, Disporum hookeri, Elymus diversiglumis (E. interruptus), Elymus villosus, Gymnocarpium dryopteris, Luzula acuminata* var. *acuminata, Luzula parviflora, Melica subulata, Moneses uniflora, Orobanche uniflora, Pellaea gastonyi, Petrophyton caespitosum, Phleum alpinum, Pinus contorta, Polystichum lonchitis, Pyrola picta, Sorbus scopulina, Vaccinium membranaceum, Viburnum lentago,* and *Viburnum opulus* var. *americanum,* are assigned a determination of **"may adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range wide"** for all action alternatives.

The "may impact individuals…" rating is based on the fact that in depth studies about the R2 Sensitive plant species and their habitats have not been undertaken and indirect effects may occur from the Elk Bugs and Fuel Project. In addition, cumulative effects to the R2 Sensitive plant species and their habitats are expected from other projects in the area as well as direct effects are expected from the adjacent legislated treatment areas.

For a more detailed description of Environmental Consequences and how they were developed, refer to the Elk Bugs and Fuels Project Biological Evaluation and the Elk Bugs and Fuels Project Botany Specialist Report in Section C.2.5 of the project file.

Rangeland

Affected Environment:

The proposed Elk Bugs and Fuel Project would encompass four active grazing allotments and four vacant allotments.

Active Allotments

The Bear Butte allotment consists of 18,597 acres and has 9 grazing permits. A total of 224 cow/calf pairs have a permitted season of use from June 10 to September 30 on a season long grazing system. There is no interior fencing and the allotment boundary is not fenced in most areas. The allotment is extremely dissected by private land, most of which is unfenced. Most of the permittees live on private land within the allotment, and turn their cattle out from their home ranch. This has resulted in small herds of stock grazing lands close to their respective home ranches, under an essentially season long system with all portions of the allotment subject to livestock grazing at any time during the grazing season.

A portion of Bear Butte creek is within the allotment. Bear Butte creek is a coldwater fishery with trout and the R2 Sensitive fish mountain sucker. Riparian vegetation is present within the allotment. Bear Butte creek is the most substantial stream providing a year-round cold-water trout fishery in the allotment. Fences, improvements, and water developments are found in this allotment.

The Runkle allotment is 13,874 acres in size of which 1,489 acres are private property. Permitted use is 128 cow/calf pairs with a season of use from June 16 to October 15. It is managed under a deferred rotation grazing system operated between the East and West grazing units. There is no interior fencing, and much of the allotment boundary is not fenced. As a result, the allotment is subject to unauthorized use by livestock from the adjacent allotment to the west (Bear Butte). The allotment has 16 water developments, 1 cattle guard and 2 miles of fence.

Most of the allotment is in the Elk Creek drainage, with minor portions in the Virkula, Forbes, Breakneck, and Tilford drainages. Elk creek is the most substantial stream providing a year-round cold-water trout fishery and the R2 Sensitive species mountain sucker for about 7 miles of stream in the upper reaches of the allotment.

The Elk allotment is located in the very southeastern end of the project boundary. It is 16,853 acres in size of which 1,290 acres are private property. Permitted use is for 85 cow/calf pairs on a 4 unit deferred-rotation grazing system operating from June 1 to October 15. The allotment has 5 miles of fence, 3 cattle guards and 5 spring developments.

The allotment is within the Little Elk Creek, Elk Creek, and Stagebarn canyon drainages. Little Elk Creek is a perennial coldwater fishery with natural reproduction of brook trout. Approximately 1,422 acres of riparian habitat are within the allotment.

The Crook Mountain allotment is located 2 miles north of Deadwood, South Dakota and is bordered on the north and east by the National Forest boundary. It consists of 4,665 acres of National Forest land and 3,420 acres of private. Permitted use is for 28 cow/calf pairs under a season long grazing system from July 1 to September 20.

The allotment is within two major drainages. Whitewood creek is a permanent coldwater fishery that is recovering from historical damage from upstream mining and dumping. Trout and the R2 Sensitive species mountain sucker are present in the creek. Approximately 250 acres of riparian habitat with perennial or intermittent water are within this allotment.

The allotment has range improvements consisting of one mile of fence, two ponds and two springs.

Vacant Allotments

The Cave, Bulldog, Pillar Peak, and Polo Peak allotments are all vacant with no permitted use at this time.

Environmental Consequences:

The effects from implementation of the Elk Bugs and Fuels Project vary somewhat by alternative. The Elk Bugs and Fuels Project Proposed action does not have any proposals for range improvements. No negative effects are expected from the no-action alternative (Alternative 1). The available forage would remain at the current level and noxious weeds would continue to spread at the current rate. Only the action alternatives would have indirect effects upon the range condition of the project area. Changes to the range include increased livestock access across the landscape (except during project implementation), increases in primary and secondary (transitory) available forage, and increased risk of introduction and spread of noxious weeds that can diminish range quality/available forage.

Effects common to all action alternatives

Direct effects from implementation of any of the action alternatives would include reduction of available forage for the season the treatment was implemented due to vegetative removal and limited access during project implementation. These are considered short-term effects (less than 5 years).

Indirect effects common to the action alternatives include reductions in risk of noxious weed spread from road decommissioning; increases in risk of the spread of noxious weeds in treatment areas left with mineral soil (such as skid trails and prescribed fire); and modest increases in available forage. In alternatives 2, 3 and 4 the proposals for commercial hardwood restoration, non-commercial hardwood restoration, and shaded fuel breaks are the same. Limited increases in secondary forage could be expected from

the acres involved in those treatment areas. The total involved acreage of the hardwood restoration and shaded fuel breaks is less than 2,000 acres. In addition, 2,264-2,347 acres are proposed for non-commercial thinning (with underburn of the thinning areas on 642 acres in alternative 3 and 858 acres in alternative 4). Some additional grass and forb development would occur in the underburn portions of the units. Over the analysis area these would be a non-significant increase in forage (less than 2,500 acres over the 60,000-acre analysis area.

Between 56 and 62 acres of road decommissioning are proposed, depending on the alternative. Reductions in roads are generally considered a risk reduction benefit to the spread of noxious weeds. However, any reductions of weed invasion risk are overshadowed by the increased risk of weed spread due to the effects of the action treatments, especially the road construction and reconstruction, prescribed fire, and tree removal.

In general the indirect negative effects from the proposed actions are increased risk of noxious weed spread from ground disturbing activities, prescribed fire, and road construction/reconstruction. Beneficial indirect effects include increased access for livestock throughout the analysis area and increases in secondary forage. The amount of treatments are described by alternative below, in general the amounts of treatment areas between the alternatives are not significantly different in terms of the difference in risk from noxious weed introduction, increases in cattle access, or amount of forage that could be generated. Refer to Appendix B for the recommended mitigation.

Alternative 2

Approximately 8,100 acres are proposed for commercial and non-commercial thinning in this alternative. Increases in secondary forage in alternatives 2 and 4 from thinning are expected to be similar. Alternative 2 and Alternative 4 have the same proposed acreage (32 acres) for bait and sanitation thinning to reduce pine beetle populations, and no acres are proposed in Alternative 3. The least amount of prescribed burning is proposed for Alternative 2 (approximately 340 acres).

Alternative 3

This alternative was developed with emphasis for wildlife species. Less acreage is proposed for commercial and non-commercial treatments (approximately 6885 acres) than either alternative 2 or 4. Increase in secondary forage from thinning in alternative 3 is expected to be less than either alternative 2 or 4. In this alternative approximately 1,760 acres are proposed for prescribed burning.

Alternative 4

This alternative was formulated to emphasize fuel reduction in the wildland-urban interface. This alternative has the largest amount of acres to be treated (approximately 8,400 acres) with commercial and non-commercial thinning. In this alternative approximately 1,635 acres are proposed for prescribed burning.

In general most forage and livestock access would be generated under alternative 4. However, this alternative has a slightly higher risk of noxious weed introduction and spread than alternatives 2 or 3.

Cumulative Effects

Any negative effects on the range resource from this project would be minimal and no different than what has occurred in the past. Present and foreseeable future activities, including the legislated activities, are not likely to impose any negative effects than what has occurred in the past. Improvements in vegetation health will always benefit wildlife and livestock. The proposals in the Elk Bugs and Fuels Project have been developed to reduce the risk of catastrophic wildfire. Wildfire areas generally are good places for noxious weeds to become established. Once established, they often take over natural habitats and reduce the range quality. Unless effective mitigation measures are implemented for this project (see noxious weed mitigation measures in Appendix B) to control and limit the spread of known noxious weed infestations, they will continue to degrade range habitat. Any adjacent timber sales or future timber sales would only exacerbate the problem. This would result in continued displacement and fragmenting of native plant communities and degradation of range quality.

Noxious Weeds

Affected Environment:

Current inventory estimates a total of 933 acres of noxious weed infestation within the project area. Weed species consist of leafy spurge (140 acres), spotted knapweed (173 acres), Canada thistle and hounds tongue (420 acres combined); scattered occurrences of St. Johnswort, musk thistle and wooly mullein and one small occurrence of teasel (located during the 2002 field surveys for rare plants).

The analysis area is well roaded, providing good vector access for spreading noxious weeds. The numerous occurrences of noxious weeds in the analysis area (coupled with the variety of species) further exacerbate the potential for spread of noxious weeds via road use (from cars/trucks, off highway vehicles, recreationists, wildlife and livestock). The analysis area has approximately 16,000 acres of private property that may also have noxious or invasive exotic weeds present. Activities on these lands or the egress to and from them also add to the risk for the spread and introduction of noxious weeds. Four active range allotments are present within the analysis area. The use of weed infested forage for livestock and other aspects of livestock management can add to the risk of noxious weed spread and invasion.

Envirnmental Consequences:

It is estimated that 80% of the lands administered by the Black Hills National Forest are infested with varying populations of noxious weeds. Soil disturbing activities associated with timber sales typically encourage the establishment and spread of noxious weeds. Left untreated, these weeds will continue to spread and result in establishment of new weed populations in adjacent areas. Historically, disturbed areas such as roads, skid trails, landings, and burn piles are most susceptible to infestation. The Purpose and Need, and Proposed Action list methods of vegetation treatment requiring specific mitigation. The mitigations are listed in Appendix B. Mitigations were obtained from the Black Hills National Forest Noxious Weed Management Plan and are the general weed prevention guidelines for site disturbing projects. Guidelines for noxious weed management specific to prescribed fire, timber harvest operations and road maintenance and rehabilitation are also in the weed management plan and will need to be followed on a site-specific basis.

Table 42 Noxious Weed Risk Assessment

Factors	Components	Variations	Risk
1. Inventory	Site specific area, identify, map, estimate numbers/acres	Inventory complete for proposed project areas within the analysis area (other portions of the analysis area is GIS mapped for previously known occurrences).	Low
2. Known noxious weeds	Number of A, B, or C-rated weeds, number of infestations, size	Leafy spurge, spotted knapweed, Canada thistle, hounds tongue, St. Johnswort, musk thistle, wooly mullein, and teasel are present in the area.	Prevention high priority; control high priority. Risk high due to presence in the area.
3. Habitat vulnerability	Previous disturbance, plant cover, soil cover, shade, soil type, aspect/moisture.	The analysis area has experienced and continues to experience many disturbances. Historic grazing has occurred in the analysis area, the area has experienced historic timber harvest, and many open areas with little to no soil cover exist adjacent to the project area.	High risk.
4. Non-project dependent vectors.	The project area is accessed by a well-maintained forest collector system. Unimproved roads	There is a network of Forest Service Roads, non-system/unimproved roads, and private roads are in the vicinity. Recreation use is	High risk.

Factors	Components	Variations	Risk
	include those used for fire and other infrastructure maintenance use.	high in the area for hiking, camping, fishing, and hunting. Equestrian use also high in the area.	
5. Habitat alteration expected as a result of project	Some of the project area could lose ground cover for several seasons.	Reduction of potential soil cover, but fuel reduction will improve the area in the long-term.	Low-moderate risk, dependant on short or long-term perspective.
6. Increased vectors as a result of project implementation	Traffic increases.	Temporary spur roads/skid trails for equipment access would be created and obliterated after use. Traffic related to project implementation would increase. Up to 62 miles of road obliteration proposed.	Low risk overall. Moderate to high risk of weed infestation on temp. roads. Road closures beneficial to risk reduction.
7. Mitigation measures	Prevention (equipment washing, weed-free materials, monitoring), control (prompt action on small infestations), cultural practices (maintain shade, minimize disturbance, design project to reduce weed flow).	If project areas are located in known weed occurrences, require that those units be entered last in an area and wash equipment prior to moving to another location or off-forest ("C"-clause). Ensure equipment coming to the project area is free from weeds. Utilize weed free straw for erosion control. Utilize gravel from gravel pits (if gravel is needed) that have been inspected and do not have noxious weeds.	Low risk if completely implemented.
8. Anticipated weed response to proposed action	Tally "high risk" responses in previous factors; consider mitigation if it is adopted as part of the proposed action.	If fully implemented, the mitigations should prevent the introduction/spread of noxious weeds.	Moderate risk for weed spread. Reduced soil cover would be created under this project in the short term.

Direct Effects

Direct effects from the implementation of any of the action alternatives in the Elk Bugs and Fuels Project would come from translocation of noxious weeds (seeds, roots, stems) into areas that are not infested, or scattering existing occurrences. Equipment that is not weed-free entering the project area or moving from a weed infestation to other areas within the project area can spread noxious weeds. Use of materials for erosion control (such as mulch, straw, and seed mixes) as well as other material such as road gravel can introduce noxious weeds if they are not weed free. National standards and Forest goals have been developed to reduce the risk of introduction of noxious weeds from these activities. These standards are found in the Appendix B: Mitigation.

Indirect Effects

Indirect effects from implementation of the Elk Bugs and Fuels Project generally fall into the category of developing habitat for noxious weeds to become established or spread from current locations. Activities leaving bare mineral soil such as skidding, landing development, road construction/reconstruction, and prescribed/pile burning all leave areas vulnerable to the introduction and spread of noxious weeds. These bare areas are inevitable in projects such as the Elk Bugs and Fuels Project, however this project has been designed to minimize any unnecessary soil disturbance. Forest goals developed to monitor project areas for following seasons to determine if noxious weed infestations have become established are listed in Appendix C, Mitigation in this document. Other Forest goals have been developed to prevent indirect effects from a project in order to reduce the risk of noxious weed spread including revegetation guidelines, coordination with nearby projects, and to maintain canopy closure where possible.

Cumulative Effects

The effects of noxious weeds can be far ranging and deleterious. Cumulative effects of implementing the action or no action alternatives are discussed in general terms**.** Extensive infestations of weeds can permanently degrade National Forest System lands based on today's economics and technology. Weed infestations in the project area are moderately extensive. Invasive non-native plants have already taken over or severely impaired millions of acres of western Federal lands, where it is estimated that weeds occur on more than 17 million acres. On National Forest System lands, an estimated 6-7 million acres are currently infested and potentially increasing at a rate of 8 to 12 percent per year.

Invasive plant species are one of the greatest threats to wildlands in the United States (Mullin et al 2000). Weed infestation and spread is one of the greatest negative impacts to maintaining or improving the health of the National Forest System lands in the project area. Plant invaders can completely alter the fire regime, nutrient cycling, hydrology, and

energy budgets in a native ecosystem. They can hybridize with native species altering native plant genetics. Maintaining or improving the National Forest System lands in the project area requires the maintenance and improvement of the basic ecosystem elements of soil, water, and vegetation. The stability and ecological function of natural wildlands depend on a diverse community of native plants (Mullin et al 2000). Native vegetation provides resilience against drought and flooding, minimizes erosion, promotes water infiltration and storage, in addition to providing wildlife and recreation values. Areas infested with weeds do not provide resilience to drought, or flooding; minimize erosion; promote water quality and quantity; or provide wildlife and recreational values at the same level as native vegetation.

Weeds arrived in the United States without the insects and diseases that preyed on them, or the plants that evolved in competition with them in their native land. Without insects, diseases, etc. to control these weeds, they increase at a rapid rate and can cause permanent degradation of National Forest System (and other) lands. Research has shown that sites dominated by weeds, have increased rates of soil erosion and runoff causing degradation of habitat for wildlife and native vegetation.

Noxious weeds known from the project area (leafy spurge, spotted knapweed, Canada thistle, hounds tongue, St. Johnswort, musk thistle, wooly mullein, and teasel) could continue to spread in the no action and action alternatives. The spread of these noxious weeds could occur on disturbed sites within and outside of the project area. The amount of soil disturbance and associated loss of soil cover is expected to contribute to the risk of spread of noxious weeds. With complete weed inventory, which was completed for the proposed project areas within the analysis area in 2002, and mitigation measures in place, a reduced risk of increased spread of noxious weeds from the Elk Bugs and Fuels Project is expected.