Appendix

K

BIGHORN NATIONAL FOREST

Final Environmental Impact Statement
for the
Revised Land and Resource Management Plan

Biological Evaluation

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Appendix K

Introduction

This Biological Evaluation (BE) describes the effects to Forest Service Sensitive species for the alternatives to the Revised Plan described in the FEIS. The legal authority for sensitive species is the Sikes Act and direction for analysis and monitoring of sensitive species occurs in the Forest Service Manual at 2670.32.

Sensitive species are those plant and animal species, designated by the Regional Forester, whose population viability is a concern on National Forests within the Region. Sensitive species may also be those species whose current populations and/or associated habitats are reduced or restricted or their habitats and/or populations are considered vulnerable to various management activities, and special emphasis is needed to ensure they do not move towards listing as threatened or endangered. The Regional Sensitive Species list was developed in 1994, and revised in 2003 and again in 2005. This Biological Evaluation (BE) is based on the new list of species generated in the latest review.

A description of each species and what is known of the current and historical distribution of that species on the Forest is included, along with the effects anticipated from implementing the alternatives described in the FEIS. Species observations on the Forest were mapped on the GIS computer mapping system with assistance from the Wyoming Natural Diversity Database (WYNDD), and the Wyoming Game and Fish Department (WGFD), among others. The sighting records are included in the planning record. Further information for each species, including recommended conservation measures that were considered, are found in the Species Assessments that are found within the project record.

Further analysis for sensitive species occurs in the biodiversity section in Chapter 3 of the FEIS, and the accompanying referenced documents for species viability in the project record.

Summary

The following determination is concluded for all Forest Service sensitive species known or suspected to occur on the Bighorn National Forest, for all alternatives to the FEIS for the Revised Plan:

> **"May adversely impact individuals or habitat, but not likely to result in a loss of viability in the planning area nor cause a trend toward federal listing or a loss of species viability rangewide."**

Mammals
Fringed myotis
Spotted bat
Townsend's big-eared bat
Water vole
American marten
Wolverine

Amphibians
Northern leopard frog
Columbia spotted frog
Wood frog

Plants
Leathery grapefern
Mountain lady'slipper
Yellow lady's slipper
Russet cotton-grass
Grass-of-parnassus
Cary beardtongue
Wooly twinpod
Tranquil golden-weed
Northern blackberry
Lesser bladderpod
Hall's fescue
White larchleaf beard-tongue

Birds
Harlequin duck
Northern harrier
Northern goshawk
Peregrine falcon
Greater sage grouse
Flammulated owl
Short-eared owl
Boreal owl
Lewis' woodpecker
Three-toed woodpecker
Olive-sided flycatcher
Loggerhead shrike
Brewer's sparrow
Sage sparrow
Grasshopper sparrow

Fish
Yellowstone cutthroat trout
Mountain sucker

Uncertainty: In determining the effects of activities on plant and wildlife species, it is important to be aware of the level of certainty with which the outcomes are determined. Available information is never perfect. Some facts and relationships are well understood; others are poorly understood. Since each decision relies on a large number of factors and predictions of effects, all decisions are made with some level of uncertainty.

For the following species, sources of uncertainty in determining the outcomes are (1) low population on the forest, which is subject to high fluctuation or loss; (2) lack of information on the status and distribution on the Forest, and (3) uncertainty about whether our habitat management will provide for all the species' needs in the long-term. The nature of this document is to assess the effects at the programmatic level of the revised plan, rather than specific ground-disturbing projects.

Forestwide Conservation and Protection Measures

Refer to the summary provided in the Biological Assessment in the FEIS (Appendix F) for a list of forest-wide direction (goals, objectives, standards and guidelines) that maintain or

enhance habitats for TES species. In addition, the Forest has also prepared a 5 Year Action Plan for Wildlife, Fish, and Rare Plant resources with specific objectives to implement under the Revised Plan. In addition, a Noxious Weed 5 Year Action Plan was also developed with specific objectives to implement under the Revised Plan. Refer to the project record for this document.

Species and habitat monitoring is specified in Chapter 4 of the Revised Plan, and project specific Biological Evaluations must be completed prior to project approval. These processes insure that uncertainties and effects are considered and evaluated and accounted for in the project design. Monitoring has also led to the identification of additional species occurrences that have reduced the level of concern for those species, primarily plants.

Proposed Action and Alternatives

For a description of the proposed action and alternatives, refer to the summary provided in the Biological Assessment, Appendix F to the FEIS.

Sensitive Species with Habitat on the Bighorn NF

The following table lists the name, habitat, and occurrence status of USDA Forest Service Region 2 (R2) sensitive species on the Bighorn NF. Many are listed due to a lack of information either about distribution, habitat associations, or effects from management activities and threats throughout its range. The Forest has largely undertaken inventory for sensitive species through site-specific project inventories, though forest-wide surveys for some species have also occurred.

Table K-1. Species, habitat, and distribution of R2 sensitive species on the Bighorn NF.

Common Name	Scientific Name	Habitat	Species Occurrence on Forest
Fish			
Yellowstone cutthroat trout	*Oncorhynchus clarki bouvieri*	Riverine	Known to streams and lakes in limited areas.
Mountain Sucker	*Catostomus platyrhynchus*	Riverine	Known to Tongue River drainage and Kearney Reservoir.
Amphibians			
Northern leopard frog	*Rana pipiens*	Ponds/wetland/ riparian	Known to limited areas.
Columbia spotted frog	*Rana luteiventris*	Ponds/wetland/ riparian	Known to limited areas.
Wood frog	*Rana sylvatica*	Ponds/wetland riparian	Known to limited areas.
Mammals			
Fringed myotis	*Myotis thysanodes*	Caves/mines & forested areas	Known to limited sites.

Common Name	Scientific Name	Habitat	Species Occurrence on Forest
Spotted bat	*Euderma maculatum*	Caves/mines & forested areas	None known, but locations near Forest and potential habitat.
Townsend's big-eared bat	*Corynorhinus townsendii*	Caves/mines	Known to limited sites.
Water vole	*Microtus richardsoni*	Riparian	Known to limited sites.
American marten	*Martes americana*	Late-successional conifer and riparian	Known to several areas.
Wolverine	*Gulo gulo*	Spruce-fir/alpine tundra	Historic/Potential with uncommon but recent sightings.
Birds			
Harlequin duck	*Histrionicus histrionicus*	Riverine	Historic/Potential as sighted nearby.
Northern harrier	*Circus cyaneus*	Grasslands/shrub-steppe	Known with many observations in mountain meadows.
Northern goshawk	*Accipiter gentilis*	Mature conifer/aspen	Known with several nesting areas.
Peregrine falcon	*Falco peregrinus anatum*	Canyons/cliffs/ riparian	Known, though sporadic but historic nesting on Forest.
Greater sage grouse	*Centrocercus urophasianus*	Sagebrush	No leks (breeding) on Forest. Late summer brood rearing primarily on west side of Forest.
Flammulated owl	*Otus flammeolus*	Mature ponderosa/ aspen	None currently known on Forest, though north of it. Limited potential habitat.
Short-eared owl	*Asio flammeus*	Grassland/sage steppe	Known/historic, though somewhat limited potential.
Boreal owl	*Aegolius funereus*	Mature conifer	Known, but from very limited sightings.
Lewis' woodpecker	*Melanerpes lewis*	Conifer/riparian	Known, but from limited sightings.
Three-toed woodpecker	*Picoides tridactylus*	Mature conifer	Known to several areas of Forest.
Olive-sided flycatcher	*Contupus cooperi*	Mature conifer	Known to several areas of Forest.
Loggerhead shrike	*Lanius ludovicianus*	Grassland	Known on fringes of Forest where meadows occur.

Common Name	Scientific Name	Habitat	Species Occurrence on Forest
Brewer's sparrow	*Spizella breweri*	Sage steppe	Known to several areas of Forest.
Sage sparrow	*Amphispiza bellii*	Sage steppe	None known on Forest, but potential.
Grasshopper sparrow	*Ammodramus savannarum*	Grasslands	Known from limited sightings.
Plants			
Leathery grapefern	*Botrychium multifidum*	Wet meadows	Known from 1 occurrence on Forest.
Mountain lady's slipper	*Cypripedium montanum*	Shady forests and riparian shrublands at mid-elevations.	Known from 3 occurrences on Forest.
Yellow lady's slipper	*Cypripedium parviflorum*	Damp mossy forests, and streamsides at mid-elevations.	Known from 2 occurrences on Forest.
Russet cotton-grass	*Eriophorum chamissonis*	Montane swamps and bogs.	Known from 1 occurrence on Forest.
Hall's fescue	*Festuca hallii*	Montane meadows	Known from 1 vague historical (1898) record.
Grass-of-parnassus	*Parnassia kotzebuei*	Moist seeps.	Known from 1 occurrence on Forest.
Cary beardtongue	*Penstemon caryi*	Disturbed areas on sedimentary soils.	Known from 14 occurrences on Forest.
White larchleaf beard-tongue	*Penstemon laricifolius ssp. exilifolius*	Rocky, calcareous hills, bare soils	Known adjacent to Forest with potential habitat on Forest.
Wooly twinpod	*Physaria didymocarpa var. lanata*	Rocky outcrops and rocky soil, without dense grass or shrub cover. Forested areas.	Known from 3 occurrences on Forest.
Tranquil golden-weed	*Pyrrocoma clementis var. villosa*	Sagebrush grasslands and montane meadows.	Known from 3 occurrences on Forest.
Northern blackberry	*Rubus arcticus ssp. acaulis*	Riparian area along Sourdough Creek	Known from 1 occurrence on Forest.
Lesser bladderpod	*Utricularia minor*	Submerged in ponds, slow moving streams	Known from 1 occurrence on Forest.

Habitat Complexes

To efficiently disclose anticipated effects of the alternatives, the 38 species were grouped by the following five general habitat associations:

- Riverine/Riparian/Pond/ Wetland.
- Caves/Mines/Cliffs/Rock Outcrops.
- Alpine Tundra.
- Mature Conifer, Aspen.
- Grassland, Sagebrush/Shrub Steppe.

Current habitat composition, structural stage, and pattern were used to analyze effects by alternative where appropriate. Information on individual species has been summarized from the species assessments conducted (see Project Record). Many of the plant and wildlife species described have limited information known about them, either at the Forest or larger scale.

Riverine/Riparian/Pond/Wetland Habitats

Yellowstone cutthroat trout *(Onchorynchus clarki bouvieri)*

Status and distribution of the species: Historically, cutthroat trout occupied the widest geographic distribution of any trout species in the United States. Of the fourteen recognized cutthroat trout subspecies, Yellowstone cutthroat trout (YCT) historically had the largest natural geographic range, with the exception of the coastal cutthroat *O. c. clarki* (Varley and Gresswell1988). The Yellowstone subspecies is indigenous to the Snake River system, upstream of Shoshone Falls, and tributaries within Idaho, Nevada, Utah, and Wyoming; and the Yellowstone River drainage, downstream to the confluence of the Tongue River in Wyoming and Montana (Varley and Gresswell1988; Behnke 1988). They were once common in these large western river basins, but are now found only in the headwater portions of these rivers. Its heritage ranking is G4/S2, indicating its global security, but local rarity.

Due to the introduction of nonnative game fish species, habitat modification or degradation, population fragmentation, and over-fishing, YCT have been reduced to a fraction of their historic range and Varley and Gresswell (1988) estimate that genetically pure populations of YCT presently occupy only ten percent of their historical stream habitat, and about eighty-five percent of their historical lake habitat. Currently, ninety-one percent of YCT habitat lies within the protected confines of Yellowstone National Park (Gresswell 1995). The US Fish and Wildlife Service concluded that a 2001 petition to list YCT does not provide substantial biological information to indicate a warranted listing at this time (Kaeding 2001; Federal Register Vol 66 No. 37, 11244-11249). The species has been petitioned again for listing in 2003, with a determination awaiting.

Population status and distribution on the Bighorn NF: There are 22 stream and 15 lake populations of Yellowstone cutthroat trout on the Bighorn NF. Little information is available as to the historic distribution of the species in the Big Horn Mountains and distribution of YCT within the Bighorn National Forest is incomplete at best. One of the earliest accounts of fish populations on the Forest, in 1893, indicated that there were no fish present in the high mountain lakes of the Big Horn Mountains (Gillette 1925). Soon after, Evermann and Cox (1894) related the abundant presence of mountain trout (*Salmo mykiss lewisii*) in the Tongue River Basin of the Big Horn Mountains. Knowledge of the historic distribution of YCT, within the Big Horn River drainage, is limited to stocking records from of the Wolf Creek Hatchery in Sheridan County, Wyoming (Report of State Fish Commissioner and Game Warden 1895). Superintendent S.E. Land was reported to have planted fry into Shell Creek, above the falls, and noted no evidence of fish in the creek, at the time of stocking. No accounts are available regarding populations in Cedar, Deer, Trout and South Paintrock Creeks, which are west slope tributaries of the Big Horn River, prior to cutthroat plants beginning in 1933.

The stocking of cultured YCT and exotic salmonids, especially brook trout, was taking place concurrently with the documentation of wild, native cutthroat trout population. Due to such early introductions, which particular waters in the Big Horn Mountains contained endemic YCT populations is in doubt. Recent surveys have documented the presence of genetically pure YCT populations in the area, providing more insight to their historic distribution on the Forest (Evans and Shiozawa 2000, 2001, 2002a, 2002b, 2003, Kruse et al.1998). These populations are primarily found in small, high elevation, headwater streams in isolated, disjunct populations.

Self-sustaining populations have been identified within or just downstream from the Bighorn National Forest boundary in the following drainages on the western slope (Refer to the Project Record Map): Trout Creek, Deer Creek, North Beaver Creek, South Beaver Creek, Cedar Creek, Mill Creek, Dry Medicine Lodge Creek, South Fork Paint Rock Creek; and in the following drainages on the eastern slope: Lodge Grass Creek, West Fork Little Bighorn River, Elkhorn Creek, Red Gulch, North Fork West Pass Creek, South Fork West Pass Creek, South Fork Little Tongue River. YCT have also been introduced into Lick Creek, Fool Creek, North Tongue and headwaters of the Little Bighorn River; however there is no evidence of natural reproduction in these populations.

Yellowstone cutthroat trout are also known to occur in the following lakes within the Bighorn National Forest: East Lake Marion, Emerald Lake, Hope Lake, Long Lake, Lost Lake (north), Lost Lake (south), Lakes of the Rough, Rhinehart Lakes, Margaret Lake, Maybelle Lake, McLain Lake, Park Reservoir, Ringbone Lake, and Upper Medicine Lodge Lake. Most of these lake populations have been historically introduced or are currently stocked by state agencies.

Beginning in 1999, the Forest began assessing YCT populations and habitat, in conjunction with the Wyoming Game and Fish Department (WGFD), to determine distribution, abundance and genetic purity of the species in and around the Big Horn Mountains. Population estimates by both Forest Service and WGFD crews have been

developed for select drainages, in conjunction with watershed assessments being completed on the Forest. Approximately 20 miles of occupied stream habitat, for genetically pure populations of YCT has been identified on the Bighorn NF and 14 miles in drainages just downstream from the Forest boundary. Due to the isolated, disjunct populations in the Big Horn Mountains, many of these populations are thought to be at risk to catastrophic events and genetic threats due to small population sizes (<500 fish) and the isolating effects of barriers. Recent monitoring suggests that the identified populations are currently stable.

Two specific research projects provide additional information on distribution and habitat of YCT on the Bighorn National Forest:

> *Distribution and abundance of salmonids in the Little Bighorn drainage, Wyoming* by Neil D. Stichert, University of Wyoming, Department of Renewable Resources, Laramie, Wyoming August 2000;
>
> *Evaluation of potential Yellowstone cutthroat trout habitat in streams on the west slope of the Bighorn National Forest, Wyoming*, by Philip D. Doepke, Department of Biological Sciences, Michigan Technological University September, 2001.

Habitat status on the Bighorn NF: Functioning stream channels with stable banks, good water quality, appropriate substrate size and composition, and cool temperatures are necessary habitat components for this species. Behnke (1992), Clark et al. (1989), and Varley and Gresswell (1988) provide excellent summaries of the life history and ecology of Yellowstone cutthroat trout.

Based on recent inventory efforts, habitat on the Forest is currently estimated as stable, though somewhat vulnerable to catastrophic events such as widespread fires or drought. The majority of YCT habitat on the Forest occurs in moderate to low gradient type stream channels, with well-vegetated, mostly stable streambanks. Existing populations on the Forest are typically found in moderately steep streams found in inaccessible valleys, which are generally more resistant to management impacts because of their inaccessibility.

Winters et al. (2003) identified 25 sixth-level watersheds on the Forest that would have preferred habitat for the long term management of Yellowstone cutthroat, based on watershed geology, rain/snow dominated hydrologic regime, and a relatively higher percentage of low gradient stream channels. Although these watersheds are characterized as having a relatively high potential for cutthroat, current habitat conditions or non-native fish populations may limit immediate management actions for YCT in these drainages.

Threats, limiting factors, vulnerability to Forest Service management activities: The largest threat to native cutthroat populations is hybridization and competition from non-native trout species. Historical introductions of brown, brook and rainbow trout have depressed cutthroat populations and have in some instances led to total biotic replacement.

The greatest decline and extirpation of native cutthroat populations have occurred at lower elevation streams, where human activities such as agricultural development and resource extraction have been concentrated and as a result modified or elimanated high quality

habitats. In addition, the easy access of these areas has encouraged angler harvest and non-native species introductions. Dam and road construction, timber harvest, overgrazing and trampling of stream banks by domestic livestock, and dewatering of streams for irrigation have also impacted populations and their habitat. The remoteness of high elevation range probably has contributed to the preservation of remaining populations, and in much of this area, public ownership has provided habitat protection that is lacking on private land (Varley and Gresswell 1988).

Currently, there are not any disease elements that appear to be outside of normal ranges for populations on the Forest. Whirling disease and the presence of the New Zealand mud snail have not been identified in the Big Horn Mountains.

The primary activities conducted by the Forest Service that would potentially impact this species are as follows:

1. Livestock grazing: Livestock grazing removes riparian vegetation (herbaceous and woody), affecting stream temperatures and hiding cover. Soil compaction and trampling affects streambank stability, water runoff/infiltration, and revegetation rates. Erosion can be increased where excesses of either of these effects occur in riparian areas. Water quality may also be affected from high concentrations of fecal material in localized reaches.
2. Road construction/maintenance: Roads in riparian areas may either provide barriers for fish migration when crossings are not properly designed, and are also a source of sediment altering stream habitat conditions.
3. Water development: Activities such as special use permits for stream dewatering/diversion occur, as have dam developments in the past, but are not anticipated to increase in the next planning period, and are not known to be affecting existing YCT populations on the Forest.
4. Dispersed recreation: This includes campsites or other activities along riparian habitats that may degrade habitat conditions through removal of vegetation, soil compaction, streambank damage and sediment increases, and chemical pollution from vehicles and activities. Fishing can also be considered as dispersed recreation and is regulated by the WGFD. This activity is one of the highest recreational pursuits on the Forest, and has the potential to introduce non-native plant and animal species, as well as disease, into stream and riparian habitats.

Conservation and protection measures: With regard to aquatic habitats, the Rocky Mountain Region of the US Forest Service (Region 2) Watershed Conservation Practices Handbook has been incorporated into the Revised Plan. Additional fisheries standards and guidelines have also been added to the Revised Plan, to deal with road placement and crossing design concerns. Standards and guidelines for livestock management and dispersed recreation have also been updated in the Revised Plan. Adherence to these measures should promote conservation and improve habitat for YCT.

The Forest plans to continue population and habitat monitoring, in conjunction with the

WGFD, and to cooperatively seek to restore native cutthroat to stream reaches where non-natives persist. Watershed improvement projects are conducted on a regular basis, including culvert replacement and road closures, and should continue to provide improved habitat conditions.

Mountain sucker *(Castomus platyrhynchus)*

Status and distribution of the species: The mountain sucker, *Catostomus platyrhynchus*, is restricted to the fresh waters of the mountainous regions of western North America. It occurs from western Saskatchewan south through Montana, western South Dakota, Wyoming, west through Utah, northern Nevada to east central California, north through Oregon and Washington to southern British Columbia. It is widespread throughout the Snake and Bear River systems in Idaho. A native Wyoming species, the mountain sucker can be found in all drainages west of the continental divide and, east of the divide, in the drainages of the northern and northeastern counties including the Tongue and Powder River drainages. It ranges to an elevation of nearly 10,000 feet in the Wind River Mountains. Mountain suckers are common in Wyoming, and prefer the clear, cold water of streams with gravel substrate. Mountain Sucker in Wyoming are more stable than populations in other western states, with a heritage program ranking of G5/S5, indicating stability. Due to recent concern over habitat and populations in Colorado, the Rocky Mountain Region of the Forest Service has listed this species as sensitive.

Population status and distribution on the Bighorn NF: Historic distribution of Mountain Sucker (MS) in the Big Horn Mountains is not known. This species has wide distribution in the drainages at lower elevations off-Forest. The only known MS populations on the Bighorn NF are found in the South Tongue River and Kearney Reservoir, on the east side of the Big Horn Mountains. These MS populations are currently stable. Populations have been identified downstream from the Forest boundary, in most drainages on the east and west sides of the mountain range. It is presumed that mountain sucker is native to the Forest. There have been no specific studies of mountain sucker habitat on the Forest, but Forest personnel will begin coordinating with the BLM and Wyoming Game and Fish to establish distribution studies of where populations are located. Predation occurs from non-native trout species, and is not thought to be at a high level of concern. Populations are largely dependent on climate related factors and water levels. There are not currently any disease elements that appear to be outside of normal ranges of this type of mortality.

Habitat status on the Bighorn NF: Upstream migrations during summer have been associated with spawning (Decker 1989). Spawning is usually thought to occur between the last week of June and the first two weeks of July when water temperature is between 11-19 C (Snyder 1983, Smith 1966, Hauser 1969), and takes place in gravel riffles (Moyle 1976). After spawning, adults are found in habitats associated with bank cover in deep pools (Hauser 1969). During the winter, riverine fish seek deep pools and interstices between gravels and other areas that are generally free of stream bottom ice. Based on recent inventory efforts, habitat on the Forest is currently estimated as stable, though

somewhat vulnerable to catastrophic events such as widespread fires or drought, should they occur. Some low gradient reaches in the South Tongue drainage exhibit impacts from past management, in the form of destabilized streambanks, but it is not known to what extent this is affecting populations of MS.

Threats, limiting factors, vulnerability to Forest Service management activities: Threats would be similar to those described for Yellowstone cutthroat trout, though this species is apparently not as sensitive to invasion from non-native species or habitat alterations as compared to the YCT.

Conservation and protection measures: Conservation and protection measures would be similar to those listed for Yellowstone cutthroat trout above.

Northern leopard frog *(Rana pipiens)*

Status and distribution of the species: Leopard frogs occur through much of North America, excluding the southeast U.S. and the far northwest areas of Alaska and Yukon Territories. Their Heritage ranking is G5/S3 in Wyoming, (NatureServe 2001) being distributed somewhat widely in the state, with much broader distribution than the other two sensitive amphibian species. However, they are declining across their range and many populations have disappeared. Amphibian populations have declined worldwide, with suspected causes ranging from loss of wetlands habitat, changing climates, competition with other species, toxins, disease, predation, and other habitat threats (Corn 1994; Smith 2003).

Population status and distribution on the Bighorn NF: Currently, they are known from several locations on the Forest, though appear limited to certain watersheds including the Big Goose, Clear/Crazy, and Tensleep drainages. The populations on the Bighorns are likely genetically isolated and distinct from other populations in the state, though genetic testing has yet to determine this to be of taxonomic or species significance. While dispersal rates for this species are not widely known, it likely has less capabilities of overland dispersal than the spotted frog.

Habitat Status on the Bighorn NF: In foothills and mountains, northern leopard frogs breed in shallow water in small ponds, often beaver ponds, with emergent vegetation along the edges. They can be found along the edges of marsh and reservoirs and in adjacent wet meadows. They hibernate in mud at the bottom of ponds. Amphibians are associated with riparian and wetland areas with perennial water, largely at the higher elevations (> 7,000', <9,500') where gradients are gentle in streams, and more ponded habitats occur. Riparian areas on the Forest have been photo-interpreted and mapped on a GIS system, and vegetation community types have been described by Girard (1997). No mapping of potential habitat occurred for amphibians for this document, though there appears to be a link to glacier created kettle ponds in terms of frequency of occurrence. It is likely that there is much more potential habitat than what is currently occupied. Efforts to delineate suitable habitat out of this potential habitat would be restricted to site-specific efforts or

analyses, due to the limited knowledge of current condition at these sites.

The condition of riparian systems on the Forest that provide habitat for amphibians are not currently at their potential as impacts from roads, livestock and wild ungulate grazing, recreation uses, and reduction in beaver abundance have reduced the potential condition. The condition of riparian systems were described in the geographic area assessments conducted for the plan revision, though condition relative to potential has not been assessed at the forest-wide or geographic scale. The Forest has been improving its management of riparian and wetland areas for the past planning period through improved livestock management efforts in coordination with grazing permittees, and improvements in road management practices. Riparian habitat is mostly stable, and existing protection measures should prevent the loss of any of this habitat type. Continued improvements are likely if ungulate grazing and browsing are appropriately managed. Improvements in road locations and design are also likely to continue across the Forest, and this may also reduce recreation impacts to these sites. Riparian habitats are vulnerable to disturbances, but are also resilient due to the association of moisture and vegetation reestablishment. Frogs have persisted despite high historic levels of grazing and other historic uses such as tie hacking. Combined, these uses have reduced vegetative cover along riparian areas, compacted soils, incised streams and eroded stream banks, and led to expansions in Kentucky bluegrass communities rather than native riparian vegetation communities. These effects vary by stream reach on the Forest. Reductions in both cattle and particularly sheep livestock grazing have occurred over the past planning period, facilitating improvement of riparian areas. However, problem areas still occur and the riparian areas are not currently managed at their potential forest-wide. Some improvements in habitat from recent beaver reintroductions are expected.

Threats, limiting factors, vulnerability to Forest Service management activities: The reason for the nationwide decline in northern leopard frog's populations is not known. Alteration in hydrology of small ponds, transmission of disease by forest visitors (for example on waders), and mortality from traffic are likely to occur, but none are known to be a major factor. Past logging adjacent to breeding sites and trampling of pond edges by livestock are possible sources of reduction of habitat quality. Of significant concern on the Forest may be predation from non-native fish species, as this has been shown to be of large detriment to other native amphibian populations when non-native trout are introduced into streams, ponds, or lakes where either no trout or smaller populations of native trout occurred (Garber 1992; Pilliod and Peterson 2000; Knapp et al 2001; Adams et al 2001). The few instances of cohabitation by trout and frogs occurring on the Forest include Meadowlark Lake, Sibley Lake, and the Tongue River drainage. The potential exclusion effect of non-native fish has not been investigated in detail on the Forest, nor have any projects removing trout and reintroducing/introducing amphibians occurred to test this effect.

Highways and culverts have also been known to have an effect on distribution of amphibians by functioning as barriers or a large source of mortality. Changes in water quality from chemical pollution (insecticides) and increased sedimentation have also been

of concern in other areas. Reductions in water flows due to agricultural or municipal uses through diversions could also affect habitat for frogs (CDOW 1998). None of these appear to be largely related to presumed declines or potentially limited distributions on the Forest at this time.

Conservation and protection measures: In order to provide management for the species to maintain and improve its potential distribution on the Forest, the following conservation measures were identified in species assessments for incorporation into Forest Plan goals, objectives, standards and guidelines. It is recognized that inclusion of these measures would not likely constitute ensured sustainability of amphibians due to uncertainties in habitat conditions, climate, and other mortality factors.

1. Manage livestock and ungulate grazing/browsing such that potential habitat is improved or maintained, particularly during drought years. Potential habitat should include all riparian and aquatic areas where perennial vegetation occurs at its edge and for approximately 20 feet into the body of water. Retention of vegetative cover at the edge of these areas would be the primary emphasis factor, as well as maintaining the ecological processes that provide for the long term maintenance of these habitats. Consider exclosures where necessary. Incorporate some areas of no livestock grazing in suitable habitat to maximize potential for amphibians.
2. Manage dispersed camping and recreational uses such that further degradation of riparian areas does not occur, and achieve improvements in existing degraded areas.
3. Provide forested cover along edges of riparian areas where it naturally exists to maintain temperature control of water.
4. Cooperate with WGFD and other partners to reintroduce beaver into historically occupied habitats, or to achieve historically estimated abundance and distribution, based on habitat suitability.
5. Coordinate with WGFD in assessing the impact of non-native trout on amphibian populations, and attempt reintroductions of amphibians in prioritized areas to provide additional populations of amphibians to improve sustainability.
6. Do not allow for the application of insecticides or herbicides in aquatic habitats, or any other chemical that would threaten water quality or aquatic life, with the exception of pesticides used to restore native aquatic life (e.g. rotenone).
7. Coordinate with WGFD in monitoring moose and elk populations and their effects on riparian vegetation. Coordinate to and achieve appropriate population levels given other multiple-use practices on the Forest.
8. Locate roads and trails outside of riparian areas to prevent loss of habitat. Use standard water quality conservation practices when conducting activities within riparian areas, including timber harvest or road and trail construction/reconstruction.
9. Assess as necessary main road crossings to determine if barriers exist, or if underpasses or more suitable crossings are necessary.

These measures were incorporated as appropriate into the list of management direction provided in the Biological Assessment. It is assumed that management of livestock grazing allotments would continue and address potential overgrazing issues. It is expected that forage competition among ungulates will increase due to the increased presence of elk and moose in the range, and this may effect riparian communities.

Wood Frog *(Rana sylvatica)*

Status and distribution of species: Wood frogs are known through much of North America, except for the western edge of the U.S. and some central and southern U.S. states. Their Heritage ranking is G5/S1 in Wyoming, (NatureServe 2001) being distributed only in the Big Horns and the Medicine Bow ranges in the state.

Population status and distribution on the Bighorn NF: Currently, they are known to a few locations in the Tongue River drainage, Big Goose, and Shell drainages. Similar to the leopard frog, the Bighorns population of wood frogs may be genetically distinct due to its isolation, though genetic testing has yet to determine this to be of taxonomic or species significance. Dispersal rates are likely similar to the leopard frog.

Habitat status on the Bighorn NF: Habitat status would be similar to that described for the leopard frog previously. Wood frogs occupy shallow glacial kettlehole ponds and high elevation beaver ponds without fish. The wood frog breeds in cooler water than other frogs, allowing it to occupy habitat farther north and at higher elevation than other frogs. Most wood frogs are found in emergent vegetation on the north side of a pond. The frogs are tolerant of freezing temperatures. Unlike many amphibians, which need hibernation sites that are above freezing (like the bottom of ponds or deeper burrows), wood frogs can overwinter in stumps, under decomposing logs, and in shallow leaf litter.

Threats, limiting factors, vulnerability to Forest Service management activities: Similar to those described for the leopard frog previously. Any impact to wetland habitat would be considered negative for this species (Muths et al 2004).

Conservation and protection measures: Similar to those described for the leopard frog.

Columbia spotted frog *(Rana luteiventris)*

Status and distribution of the species: Spotted frogs are known to northwest North America. Their Heritage ranking is G4/S3 in Wyoming, (NatureServe 2001) being distributed mostly in the Greater Yellowstone area and the Big Horn Mountains. Columbia spotted frogs have undergone genetic testing over their range in the past decade, with the *luteiventri*s species being split off from the previous *pretiosa* species. The Utah population segments of this species were petitioned for listing but were precluded due to higher priorities, which resulted in the development of a Conservation Agreement and Strategy (Perkins and Lentsch 1998).

Population status and distribution on the Bighorn NF: Currently, they are known to a few locations in the South Fork and North Fork Tongue River drainage on the Forest. Recent genetic testing has indicated that the population of spotted frogs on the Bighorn NF is genetically distinct, but is closely associated with populations in the continuous range of the species (i.e. few mutations) (Bos and Sites 2001). There has been no proposed reclassification of this population into a further subspecies. While dispersal rates for this species are not widely known, it has been reported as being capable of dispersing across overland habitats and for several miles along riparian corridors (Reaser 2000).

Habitat Status on the Bighorn NF: This would be largely similar to the description for leopard frogs above. With its likely confinement to the South Tongue drainage, there are more site-specific considerations. Recent watershed improvements have been conducted to reduce sediment, and grazing practices are currently being addressed through implementation of an Allotment Management Plan revision (Tongue EIS). This area also receives a large amount of dispersed recreation use compared to other watersheds on the Forest.

Threats, limiting factors, vulnerability to Forest Service management activities: These would be similar to those described for the leopard frog above.

Conservation and protection measures: These would be similar to those described for the leopard frog.

Water vole *(Microtus richardsoni)*

Status and distribution of the species: Water voles are known only to northwestern North America, occurring from British Columbia and Alberta south to Utah. Populations are considered most secure in Washington and Canada (NatureServe 2001). In Wyoming, the species is considered a G5/S2 species by WYNDD (2003).

Within Region 2 of the Forest Service, this sensitive species is only known to occur on the Bighorn and Shoshone NFs, though they are distributed through many parts of the Rocky Mountains, including other Forests in Wyoming, as described in Klaus and Beauvais (2004). The Bighorn locations are the eastern extent of its currently known range. Sensitive status is largely based on perceived impacts from livestock grazing and other impacts focused in riparian areas.

Population status and distribution on the Bighorn NF: Historic population levels are unknown on the Forest, and only recently have more extensive surveys been conducted to determine its distribution on the Forest. These efforts have largely been from Klaus in 1997-2001, though the Forest has also conducted its own surveys in areas not covered by Klaus, associated with livestock grazing allotment plan revisions. Trapping is conducted in August and September to coincide with seasonal peaks in population levels. Water voles are not frequently found on the Forest, as demonstrated in surveys by Klaus, where they were found in only 14 out of the 21 streams surveyed that constituted potential habitat. Current known distribution on the Forest is displayed in the species assessment in

the project record, and depicts survey efforts specifically targeting water voles. Complete surveys of the Forest have not occurred, and baseline information on distribution is not anticipated for approximately one more decade at the current level of survey effort. Compared to other locales, water voles are likely less abundant on the Bighorns (Klaus and Beauvais 2004), based on the low number of captures, and the low percent of occurrence in potential habitat. In addition, there is a less obvious sign of their occupation here compared to other areas. Obvious signs include runways and latrines in other locales, whereas trapping is necessary on the Bighorn to determine presence or absence. Water vole populations on the Bighorn are likely at reduced levels from other locales due to past and ongoing effects to habitat primarily assumed to be associated with livestock grazing. Water vole populations may boom in exceptionally high moisture or runoff years, assisting dispersal and colonization.

The populations on the Big Horns are also thought to be genetically isolated and distinct from other populations in the Rocky Mountains (Beauvais 2000), though this has not yet been determined to be of taxonomic or species significance. Currently, the voles in the Big Horns are described as the subspecies *macropus*, and appear most genetically similar to populations in Utah, though this is based on very preliminary genetic testing.

Dispersal is largely along riparian corridors, though overland dispersal is also likely, particularly in wet years when ephemeral drainages are flowing and populations are higher (Klaus and Beauvais 2004). Dispersal into unoccupied habitats is likely largely limited by suitability of habitat on the Forest. High runoff also causes occurrences lower in elevation than typically occupied habitat. Populations on the Big Horns may have genetic flow occurring on the Forest, though genetic flow into the Big Horns is not likely.

Habitat Status on the Bighorn NF: Voles are mostly associated with alpine and subalpine (typically above 7,500') riparian and wetland areas with perennial water, a valley-bottom slope of 5 degrees or less, more narrow stream channels of Rosgen type B or E channels with gradients of 7 percent or less, and vegetation dominated by willows, sedges, grasses and forbs. These parameters are based on known locations or observations, and there is potential for occurrences in other Rosgen stream types (C, D). Riparian areas on the Forest have been photo-interpreted and mapped on a GIS system, and vegetation community types have been described by Girard (1997). The willow/wet Carex community type is most often associated with water vole captures. By querying the GIS database based on these parameters (perennial streams above 7,500', less than 10% gradient; riparian communities H1-4 and S1-3) the following amounts of **potential** habitat were found on the Forest. The areas are also displayed in the map in the species assessment in the project record. Efforts to delineate suitable habitat out of this potential habitat would be restricted to site-specific efforts or analyses, due to the knowledge required of current condition of these sites. Currently occupied habitat is likely less than 5% of potential, based on currently known distribution.

Table K-2. Miles and acres of potential water vole habitat on the Bighorn National Forest, by geographic area.

Geographic Area	Miles of Potential Stream Habitat	Acres of Potential Habitat
Tongue River	120	4,766
Clear/Crazy	91	4,264
Shell Creek	71	2,738
Tensleep Creek	53	2,532
Paintrock Creek	73	2,387
Goose Creek	60	2,302
Piney/Rock	36	2,067
Little Bighorn	31	1,491
Devil's Canyon	19	1,360
Total Potential	554	24,267

The condition of riparian systems on the Forest for this species would be similar to the conditions described for the leopard frog above. Voles have persisted despite high historic levels of grazing and other historic uses such as tie hacking.

Threats, limiting factors, vulnerability to Forest Service management activities: The conclusion of Klaus (2003) was that livestock grazing effects to habitat were of the greatest concern. All other activities of potential threat would be similar to those listed for the Yellowstone cutthroat trout, including roads, dispersed recreation, and noxious weeds. Voles are not known to be affected by disturbance from people during breeding seasons or other seasons.

Conservation measures: Conservation measures for this species would be similar to those listed for the leopard frog, with the exception that there are no known non-native species impacts currently occurring with the vole that are significant to either habitat or individuals and populations. Barriers such as culverts or other restrictions on the stream are also not known to be a factor for this species.

Harlequin duck *(Histrionicus histrionicus)*

Status and distribution of the species: Known primarily from the northwest and northeast portions of North America and southern Greenland, harlequin ducks occupy clear, fast-flowing rivers and streams for breeding habitat in the summer, and are known as excellent swimmers (Robertson and Goudie 1999). Winter habitat is comprised of rocky coastal shorelines. While considered a G4 species globally (relatively common), it is considered an S1 species by the State Natural Heritage ranking for Wyoming. It is known to occur in the Shoshone NF and the Greater Yellowstone Ecosystem, as discussed in recent nest surveys conducted by the WGFD (WGFD 1999; WGFD 2003). Canada has listed this species as endangered, and several other states and National Forest regions list it

as sensitive or the equivalent. Population declines in the eastern portion of its range appear to have been stabilized, though the overall population remains small. In its western range, populations may have declined, though breeding populations in the Rocky Mt. Region appeared stable during the 1990s (Robertson and Goudie 1999).

Population status and distribution on the Bighorn NF: The species was observed in early summer of 2005 along the Tongue River. Prior to this, the last recorded observations were from Shell Creek and the Little Bighorn River, all from the late 1970's and one from 1990 (Downing 1990). The ducks are considered potential breeders in the northern latitudes of the Forest by the WGFD (WGFD 1999). It is unknown if the current population status is more or less than what occurred historically.

Habitat status on the Bighorn NF: As the Bighorn is likely at the far southeast extent of this species' distribution (Robertson and Goudie 1999), it is not likely that the Forest provides much suitable habitat. Larger river systems with a boulder type of substrate that could provide potential habitat would include the two river systems mentioned above, plus the Tongue River, Piney Creek, Paintrock Creek, and possibly Devils Canyon. Nests are constructed primarily within 5 meters of the water, on islands, or in small cliff ledges, tree cavities, bushes or stumps. The riparian structure of the streams considered to be potential habitat on the Forest is largely intact. Portions of the Tongue River and the Little Bighorn and Shell Canyon have hiking trails along one side of the stream, and use is considered to be low. Because these streams are armored with boulders, they receive little grazing use. None of these potential streams have logging or road building impacts at the lower elevations, and water quality is considered good at the Forest boundary, indicating few impacts from sediment or siltation. Highway 14 along Shell Canyon may provide some impacts for the first mile of habitat near the Forest boundary, but effects otherwise are negligible.

Threats, limiting factors, vulnerability to Forest Service management activities: The primary threats to the Harlequin duck appear to be hunting and disturbances on breeding grounds, typically from recreation use such as rafting or hiking. The most vulnerable period appears to be in May from the breeding disturbance perspective. However, they are also noted to be relatively tame, and return to nests after being flushed (Robertson and Goudie 1999). While several states have bag limits for hunting, hunting is largely banned in Canada, and there is no season for the ducks in WY. Other suspected threats include toxic pollutants along coastlines, and some mortality associated with fishing nets along the coasts. It is also expected that increased siltation in streams may upset their invertebrate prey base, and dam construction removes potential habitat.

Conservation and protection measures: There have been no specific conservation measures employed on the Forest for this species, since its current occurrence is unknown. Applicable measures could be recreation use restrictions in areas where nesting was found. In addition, water quality measures as mentioned for the YCT would also be applicable. Reports of any sightings should be reviewed to determine if nesting is occurring on the Forest.

Leathery grapefern *(Botrychium multifidum)*

Status and distribution of the species: The species is known to occur in North America in all but southern and central U.S. (NatureServe 2003). Its heritage ranking is G5/S2, indicating global security, but rarity in Wyoming. Its overall status or trend is largely unknown, though most of the states and provinces list it in a less vulnerable status than Wyoming, perhaps due to the fact that Wyoming is on the eastern fringe of its known range down through the Rockies.

Population status and distribution on the Bighorn NF: This species was first found in 2004 on the Bighorn, in Big Goose Creek near the Big Goose Ranger Station. This is the only known population on the Forest currently, though no other searches have been made following the initial find last year. There are other locations in Wyoming, and thus there is likely other potential habitat on the Forest where this species has not been searched for. Population size at the location is largely unknown, as only several plants were discovered during a prescribed burning operation.

Habitat status on the Bighorn NF: *Botrychium multifidum* grows primarily in meadows and moister bottomlands, up to 9,500', with the plant on the Bighorn being located at approximately 7,800'. As the species disperses via spores, how widely distributed is on the Bighorn NF is unknown. Habitats are considered mostly stable on the Forest, as livestock grazing from historical levels has been greatly reduced. Areas of overuse from livestock and damage from dispersed recreation use still occur, but tend to be localized in these habitats. Some botrychiums require disturbance to regenerate (suitable seedbed), but it is not currently known to what degree this one requires this.

Refer to the habitat described for the water vole for a description of the habitat status for this species.

Threats, limiting factors, vulnerability to Forest Service management activities: Threats to *Botrychium multifidum* habitat are speculative. As mentioned previously, any activity that causes soil loss or long term decline of meadow and riparian resources would cause a reduction in this species' habitat. Livestock grazing and dispersed recreation are two of the most typical types of this type of use on the Forest. It is not known to be an important diet item for livestock. It is not known to what extent, if any, fire may play a role in this species' habitat. Logging activities do not typically take place in this species' potential habitat, but skidding or other ground disturbance would have the potential to impact this plant or its habitat. Non-native species would likely be a significant threat, particularly at lower elevations.

Conservation and protection measures: Standard protection measures, such as survey and locate prior to treatment, should largely be successful for this species for ground disturbing projects. Riparian habitat protection and protection from severe burning conditions would also be desirable. Additional surveys need to be conducted on the Forest to better assess its known distribution and gather information on habitat. The current site

is located within an exclosure, and therefore receives little, if any, livestock grazing pressure.

While the 300' forested riparian guideline may help foster habitat for some species, this particular plant may require more disturbance in this zone, which is allowed under this guideline.

Mountain lady's slipper *(Cypripedium montanum)*

Status and distribution of the species: The species is known to occur in northwest and western North America (NatureServe 2003). Its heritage ranking is G4G5, indicating global security. Its state ranking in Wyoming is S1, as the populations on the Bighorn NF are the only known locations in Wyoming, thus making it a rare species for the state. Its overall status or trend is largely unknown, though most of the states and provinces list it in a vulnerable or lower status, which may be a function of current search effort rather than habitat or population loss.

Population status and distribution on the Bighorn NF: There are 3 known locations on the eastern slope of the Bighorn NF in Johnson and Sheridan Counties (Fertig 2000). These locations have many populations of the plant. In particular, numerous populations were found during surveys conducted for the Story Fuels project in the Piney Creek area. Total population size on the Forest ranges from 50-1000 individuals. In 2002 Gregory Karow, Ralph Fink and Tucker Galloway censused the South Piney Creek population. It covered approximately 180 acres, and had approximately 700 individuals. Approximately 80-90% of the plants observed were flowering in the third week of June. Additional populations of this plant were found in 2003 and 2004 on the Forest.

Habitat status on the Bighorn NF: *Cypripedium montanum* grows in a wide variety of habitats, from mesic to dry coniferous forest, dry slopes, around shrubs, openings, and deciduous forests often with *Betula* and *Populus* from 5000-6600 feet (Fertig 2000, Seevers and Lang 1998). Because of this association with birch and poplar/aspen, it was addressed in this section under riparian habitat. In the eastern Cascades, *Cypripedium montanum* sites range in canopy cover from 30-60 %, and occur at early to mid-successional sites such as road cut-banks, trail sides, and previously harvested stands (Knecht 2001). In general, *C. montanum* grows in small forest openings with little competing vegetation that have enough light for soil warmth, but enough shade to maintain soil moisture (Huber 2002).

In general, most of the forested areas on the east slope of the Bighorns are dominated by pole-sized stands with greater than 60% canopy cover as indicated by CVU data. There is likely an abundance of potential habitat on the east side of the Forest, with likely less potential habitat on the west side of the Forest. There is the potential for much more of this plant as compared to existing known populations, all a function of current survey effort. However, most of the potential habitat may currently be in a too dense of a canopy condition for this species, and some disturbances (natural or otherwise) may actually benefit this species. The Forest is currently monitoring results of the Story project to

refine habitat responses of this plant on the Forest.

Threats, limiting factors, vulnerability to Forest Service management activities: Threats to *Cypripedium montanum* habitat are speculative. One known threat is the picking of flowers by enthusiasts, while potential threats include fire, logging and grazing. Grazing is not considered a threat on Bighorn NF *Cypripedium* sites, because of the largely forested habitats. Conflicting reports on the impact of fire on *C. montanum* are based on speculation and short-term studies. One risk from fire is that the intense heat will destroy mychorrizal symbionts. *Cypripedium* species are dependent on mycorrhizal associations for years before above ground growth can begin. *Cypripedium montanum* plants do not produce flowers until about 6 years after germination (Huber 2002). In contrast to this risk, fire suppression may decrease habitat for *Cypripedium montanum*, because *Cypripediums* seem to be an early succession species that occupy open sites until forests mature and push them out (Morse 2001). Fire suppression may be the largest threat to the populations located in developed areas (NatureServe 2003).

Conservation and protection measures: Standard protection measures such as survey and locate prior to treatment should largely be successful for this species. However, this should not mean no treatment within potential habitat due to the factors acknowledged above. Riparian habitat protection and protection from severe burning conditions would be desirable as described above for other species.

While the 300' forested riparian guideline (Forest-wide Biodiversity #9) may help foster habitat for some species, this particular plant may require more disturbance in this zone, which is still allowed under this guideline.

Yellow lady's slipper *(Cypripedium parviflorum)*

Status and distribution of the species: The species is known to occur throughout most of North America (NatureServe 2003), though taxonomic questions persist on varieties, etc. Dorn only lists one Yellow Lady's Slipper for Wyoming, *Cypripedium parviflorum var. pubescens* (Dorn 2001). Thankfully, Dr. Charles Sheviak, an expert in the genus, has temporarily resolved the issue by stating that all "yellow lady's-slippers" will be equivocally referred to as *Cypripedium parviflorum* until the three infraspecific taxa can be distinguished (USDA Forest Service 2003). Its heritage ranking is G5, indicating global security. Its state ranking in Wyoming is S1S2. *Cypripedium parviflorum* has approximately 7 extant and 2 historical occurrences in Wyoming (Fertig 1999). According to Sheviak; however, the precise distribution of infraspecific taxa within Region 2 is uncertain (Morse 2001). Its overall status or tend is largely unknown, and many of the states have not listed its status in terms of a heritage ranking (NatureServe 2003).

Population status and distribution on the Bighorn NF: There are several known locations in Sheridan County, on the eastern edge of the Bighorn NF. Populations exist near the Story Fish Hatchery, the Red Grade Road, and in Little Horn Canyon. Information on population size is not known, but most are thought to be small (Fertig

1999). The population in Story observed by Tucker W. Galloway and Ralph Fink in 2002 contained about 10 flowering plants, and probably was one of several subpopulations in the area.

Habitat status on the Bighorn NF: *Cypripedium parviflorum* is generally found in mesic grasslands, woods, bogs, or near streamsides from 4000-8000 feet elevation. *Cypripediums* seem to be an early succession species that occupy open sites until forests mature and push them out (Morse 2001). As discussed above for *C. montanum*, additional habitat may occur in the moist cool forested canyons on the eastern slope of the Bighorns (Fertig 1999). There may an abundance of potential habitat on the eastern slope of the Bighorns that remains unsurveyed, and may be in a more mature status of succession than is desirable for this species.

Threats, limiting factors, vulnerability to Forest Service management activities: Threats to the habitat are currently unknown. Threats to the plants include grazing and picking by wildflower enthusiasts (Fertig 1999). Habitats may be vulnerable to fire-exclusion and associated wildfire damage.

Conservation and protection measures: These would be similar to those mentioned for *C. montanum* above. The Forest Plan conservation measures are also the same as *C. montanum*.

Russet cotton-grass *(Eriophorum chamissonis)*

Status and distribution of the species: The species is known to occur primarily in northern North America (NatureServe 2003). Its heritage ranking is G5, indicating global security. Its state ranking in Wyoming is S2, indicating a rarity that may be based on survey effort rather than habitat or plant loss, as Wyoming is the southern tip of its range in the Western U.S.

Population status and distribution on the Bighorn NF: One population occurs on the Bighorn NF in the Preacher Rock Bog (Welp and Fertig 2000). There are no other known populations on the Bighorn.

Habitat status on the Bighorn NF: *E. chamissonis* prefers bogs and swamps from 7,300 – 8,300 feet. Preferred habitat includes substrate around the margins of ponds (in mud), marshes and imperfectly drained silt with high organic content. The species has been reported in marshes with *Carex aquatilis* var. *stans*. Unsurveyed habitat may occur in bogs of the kettle pond country of the Cloud Peak Wilderness (Fertig 1999). There are numerous other sites of potential habitat in the Forest that have not been surveyed.

While ponded habitat is likely secure on the Forest, and would continue to be with revised plan standards and guidelines, the margins of some ponds may be more heavily used by ungulate grazing, primarily livestock. Discussions above for amphibian habitat would be similar for this species. In addition, some of the ponds that provide potential habitat are likely advancing successionally through eutrophication, and no new ponds are being

created. Reservoir construction in the past may have removed some potential habitat, though this is also speculative. The Preacher Rock Bog has an exclosure fence around it to protect it from livestock grazing.

Threats, limiting factors, vulnerability to Forest Service management activities: Hydrological changes such as drought, heavy grazing, or pollution could affect habitat. Many of these same threats were addressed for other riparian species.

Conservation and protection measures: Measures that protected pond-edge habitat would be of most benefit, similar to those listed for the amphibian species above.

Grass-of-parnassus *(Parnassia kotzebuei)*

Status and distribution of the species: *Parnassia kotzebuei* ranges from Alaska to Newfoundland across northern North America, and in the U.S. in the Rocky Mountains from Montana to Colorado, and in Washington, Idaho and Nevada (NatureServe 2003). There are at least 10 known locations in Wyoming (USDA Forest Service 2003). In Wyoming, *P. kotzebuei* population and trend data are generally unknown.

Population status and distribution on the Bighorn NF: Only one population is known to occur on the Forest in Johnson County.

Habitat status on the Bighorn NF: In Wyoming, *P. kotzebuei* inhabits subalpine and alpine wet rocky ledges in streamlets and moss mats on thin clay soil. It is also found near lakes or creeks from 9,400-11,200 feet elevation (McJannet 2000, USDA Forest Service 2003). This type of habitat will mostly be found within the Cloud Peak Wilderness Area of the Big Horn Mountains. Due to this location, it is presumed that habitat is largely secure. It is also very likely that there are many more areas of potential habitat on the Forest that have not been surveyed.

Threats, limiting factors, vulnerability to Forest Service management activities: *Parnassia kotzebeui* habitat is near water and often on rock ledges above 9,000 feet elevation. This elevation restricts *P. kotzebeui* habitat mostly to the wilderness, and rock ledges are shielded from most threats. This habitat type is stable under current management. Potential threats are not known, though there may be some impacts from recreation use, but this is likely in very small and isolated sites.

Conservation and protection measures: Due to the isolated nature of potential habitat, few, if any, conservation measures are considered necessary. Of greater importance would be additional surveys to determine this plant's distribution, and any site-specific potential threats to individual populations.

Northern blackberry *(Rubus arcticus ssp. acaulis)*

Status and distribution of the species: *Rubus arcticus ssp. acaulis* is found from Newfoundland to Alaska south to Minnesota, and at the southern tip of its range in

Wyoming and Colorado (NatureServe 2003). Wyoming has 3 known populations of *Rubus arcticus ssp. acaulis*. Two occur in Yellowstone National Park, and 1 is known from the Bighorn NF (Fertig 2000). Most of the provinces have not been evaluated in terms of a heritage ranking for this species, but for the three for which it has been, it is listed as secure, and one is S2. For the two states in the U.S. for which the ranking has been done, it is listed as S1. Trend data is largely unknown.

Population status and distribution on the Bighorn NF: There is 1 known location on the Forest found on Sourdough Creek (Scholl and Smith 2001). The area is managed for multiple-use with significant emphasis on livestock grazing, timber harvesting and recreation. *Rubus arcticus ssp. acaulis* is mainly found on the south side of the stream. This may be because the north side is less subirrigated and drier. Along the stream, seasonal flooding keeps the soil moist on the north and south sides of the stream, but the north side has a steep slope that begins several meters from the stream bank. Major vegetative cover on the north side is achieved by *Poa pratensis, Deschampsia cespitosa* and *Phleum alpinum*. Northern blackberry in the Big Horn Mountains seems to depend on seasonal flooding for moisture and an influx of sandy alluvium. The area was once flooded as a tie-hack dam (ca. 1930), but is now only subject to natural seasonal flooding, grazing and recreation activities (Fertig 2000). The population at Sourdough Creek contains up to 70,000 stems, and covers a 1.5-mile stretch of stream. The true number of genetically distinct individuals is probably less because of its rhizomatous nature (Fertig 2000).

The lone population on Sourdough Creek was first discovered in 1900, and relocated in 1994 by Stephanie Mills and Kathy Zacharevics, Bighorn NF seasonal field technicians, while conducting riparian classification surveys (Fertig 2000). Extensive, Forest-wide riparian classification surveys by Bighorn National Forest staff in the 1990s. Surveys done by Zacharevics and Mills in 1994-95 targeted Sourdough, Middle Clear, South Clear, Circle Park, Grommund, Pole, Caribou, and Hesse Creeks. In addition, 1999 surveys conducted by Fertig in Little Sourdough, North Fork Crazy Woman, Muddy, Circle Park, South Clear, Little North Fork Crazy Woman, and Doyle Creek did not detect any new populations (Fertig 2000). Fertig developed a population trend monitoring program that has been recorded annually since 1999. Trends to date seem to indicate a stable population, over time, with year-to-year fluctuations largely a function of precipitation amounts.

Habitat status on the Bighorn NF: In the Sourdough population, *Rubus arcticus ssp. acaulis* inhabits boggy marshes of a *Salix planifolia* community thriving especially on the mossy hummocks along the stream, and also along streambanks in wet shady spots under Engelmann spruce stands. Plants grow in both low to dense canopy cover from 7000-9000 feet. Most of the plants are within 7 meters of the stream, but occur up to 30 meters from the stream bank. *Rubus arcticus ssp. acaulis* may occur in full sun to complete shade beneath shrubby cinquefoil, *Salix* spp., or Englemann spruce. Vegetative ground cover is 90-95%, with 50% provided by mosses (Fertig 2000).

Threats, limiting factors, vulnerability to Forest Service management activities: *Rubus arcticus ssp. acaulis* seems to be very resilient to management activities and hydrologic disturbances and occupies a variety of habitats, but the single population in the Big Horn Mountains could be susceptible to extirpation if Sourdough Creek is thoroughly disturbed (Fertig 2000). Grazing is not considered a threat as the habitat occupied is sufficiently wet so as to deter cattle grazing.

Conservation and protection measures: The major priority for the Bighorn NF is to preserve and continue to monitor the Sourdough population and address any resource issues that become evident. More populations in the Big Horn Mountains are not likely, as the forest personnel that 're-discovered' the population in 1994 and WYNDD has surveyed many streams in search of *R. arcticus ssp. acaulis*. Several permanent monitoring transects were set up by WYNDD and the Bighorn NF for populations on the Forest in 1999, and revisited annually since to collect population trend monitoring data. No significant changes have been noted, but this is a short period of time and a small sample size. Livestock grazing does not appear to be a threat at the current levels.

Continued maintenance of riparian functioning as described for other species above would benefit for this species. It is not clear what role hydrologic functioning plays for this species, in terms of disturbance needed vs. protection.

Lesser bladderpod *(Utricularia minor)*

Status and distribution of the species: This species is located throughout Canada and Alaska, and approximately the northern half of the lower 48 states of the U.S. (Nature Serve 2003). *Utricularia minor* is known from 5 extant and 1 historical occurrence in Wyoming (Fertig 2000). Its overall trend status is largely unknown, as half of the states and provinces for which it is listed as occurring is secure, and the other half are either not evaluated or are listed as rare/imperiled in terms of heritage ranking. Wyoming is at the southern periphery of its range.

Population status and distribution on the Bighorn NF: There is 1 known population on the Forest found in 1963, "near the head of Tensleep Creek" (Scholl and Smith 2001). There has not been an extensive survey for this plant on the Forest.

Habitat status on the Bighorn NF: *Utricularia minor* is a carnivorous plant that inhabits shallow ponds, lakes, and slow-moving streams from 6,600-8,600 feet (Fertig 2000). Invertebrates as prey include fairy shrimp (*Branchiopoda*), Water Fleas (*Cladocera*), Copepods (*Copepoda*) and Scuds (*Amphipoda*) (Boreal Forest 2003). *U. minor* also preys on paramecia, rotifers, nematodes, and microscopic insect larva.

In the one Bighorn NF population, associated species include *Carex* spp., *Nuphar* and *Menyanthes* (Scholl and Smith 2001). Habitat includes fens and open bogs in calcium-rich shallow water. Additional unsurveyed habitat exists on the Forest in slow-moving streams and ponds, though this potential habitat nor its extent has been assessed.

Threats, limiting factors, vulnerability to Forest Service management activities: Threatened by loss or deterioration of wetland habitat (Fertig 1999). Populations are small and restricted to specialized microsites (Fertig 1999).

Conservation and protection measures: The current priority for the Forest is to relocate the existing population on the Forest, and survey potential habitat for additional populations. *U. minor* may be more widespread than is currently known, because of its inconspicuous appearance (Fertig 2000).

It is presumed that maintaining riparian habitat with stable streambanks and an intact macroinvertebrate community would be of benefit for this species, similar to conditions listed for other species above. It is not known what role disturbance and hydrologic functioning plays for this species, though it is presumed that this plant occupies a more mid-late seral riparian community due to its association with Carex species.

Direct, Indirect, and Cumulative Effects on Riverine/Riparian/Wetland Habitat and Associated Species

Direct effects from any Forest activities are likely to be minimal or nonexistent to individuals or populations, but existing or potential habitat effects could occur from alterations resulting from road construction, timber harvest activities, dispersed recreation, and livestock grazing. These effects are described below. There are no additional reservoirs currently proposed or planned. There are no known proposals for additional mineral developments, or oil and gas developments, at this time on the Forest. Direct effects could also be viewed by looking at the allocation of management categories and prescriptions. The survey and manage strategy provides opportunities for avoidance or mitigation during project planning, as referenced in forest-wide standards and guidelines.

Indirect effects such as changes in water quality due to sediment or riparian habitat could continue to occur from the above listed activities. With implementation of the Watershed Conservation Practices Handbook in the Revised Plan with all alternatives, some degraded areas may be improved, while negative impacts would be minimized. Fisheries habitat standards and guidelines were also added to the Revised Plan that were not present in the 1985 Plan. There would be minimal timber harvesting within 100' of perennial streams and likely reduced harvest within 300' of streams and riparian areas due to the new guidelines in place. New stream crossings from roads and trails are likely to increase the most in Alternatives E and A with associated road needs, as displayed in the FEIS. There would be progressively fewer stream crossings constructed in Alternatives D, B, and C, respectively. Stream crossings are a potential source of sediment or barrier for any of these animal species or their prey, and any additional stream crossings could be a loss of potential habitat for some species. In general, those alternatives that have more category 1 – 3 prescriptions would likely pose less of a threat to riparian resources due to less likelihood of road construction in riparian areas. As a specific example, the following table shows the distribution of management categories by alternative for YCT occupied habitat.

Table K-3. Number of stream and lake populations of Yellowstone cutthroat trout by management area groups.

Management Area(s)	# of Stream Populations					
	Alt. A	*Alt. B*	*Alt. C*	*Alt. D FEIS*	*Alt. D DEIS*	*Alt. E*
1, 2, 3	17	19	19	13	12	10
4	0	2	1	1	1	0
5	13	7	3	12	12	15
5.4	0	0	0	4	0	0
Management Area(s)	**# of Lake Populations**					
	Alt. A	*Alt. B*	*Alt. C*	*Alt. D FEIS*	*Alt. D DEIS*	*Alt. E*
1, 2, 3	14	15	14	13	12	11
4	2	1	1	2	2	1
5	0	2	0	0	1	1
5.4	0	0	0	0	0	0

Note: The total number of populations for each alternative does not match due to occupied habitat being in multiple management areas depending on alternative.

The 5.4 prescription was split out in the table above as specific direction was added to this management category to provide improved riparian habitat, including road/stream crossing guidelines and other measures.

Wildfires would likely have the largest indirect impact on habitat in terms of water quality, where large acreages that could potentially burn may have watershed impacts such as increased sedimentation. There is little difference among alternatives with regard to wildfires, as most large fires in subalpine forests are dependent on drought related conditions combined with wind events, rather than stand structure and/or access. Alternatives C and B may have the most potential for wildfires due to the predominance of management category prescriptions 1 – 3. With additional roading highest in Alternatives E and A, there may be improved fuel conditions and access for suppression, though this may be offset by an increased potential for human ignitions associated with recreation use.

Motorized dispersed recreation may decrease in riparian areas due to the Revised Plan direction to restrict summer motorized travel to open, designated roads and trails. Projects implemented under the plan would prioritize locating motorized routes outside of riparian areas. Revised Plan standards and guidelines were also developed to discourage dispersed camping in riparian areas, with prioritization in municipal watersheds. However, recreation use would likely continue to increase, with potential hiking and fishing impacts along stream corridors continuing. Alternatives E and A would have the greatest potential for more opportunities of motorized recreation, tapering off through Alternatives D, B, and C respectively.

Indirect effects from livestock grazing are the same for all alternatives, and with administration to standards and guidelines in the Revised Plan, it is anticipated that riparian conditions would continue to improve, although slowly, over time.

The spread of noxious weeds can indirectly degrade riparian areas significantly by changing existing vegetation to undesirable and non-soil binding vegetation. Increased erosion or other changes could result from a change in plant communities. Noxious weeds may spread more easily along roads or where mechanized equipment or vehicles are used. Increases in these types of activities over current levels would be most likely in Alternatives E and A, while there would be more moderate increases in road disturbances in Alternatives D, B, and C, respectively. It is projected that 4 miles of road decomissioning would occur for all alternatives, per year, with most of these miles likely occurring on user-created roads and unused system roads that have gone through the travel management and roads analysis process at the project scale. Possible increased protections obtained from Wild and Scenic river designations would only be achieved in Alternatives C, B, and D-FEIS, and may or may not improve habitat for sensitive species. Livestock and recreationists would continue to be a source of noxious weed transport in riparian areas, regardless of alternative. Alternatives which provide additional RNAs, B, C, and D, also provide some level of protection from some of the plant species.

In general, the **cumulative effects** analysis area considered for this habitat type and associated species includes the Forest and one mile adjacent to its boundary. The future time period includes the foreseeable planning period (10-20 years). For fish species, the cumulative effects area is the 5th level HUC watersheds on the Forest and those that overlap or extend off of it. Analysis for these watersheds was conducted in the Aquatic Ecosystem Assessment conducted for the Revised Plan (Winters et al 2003), and in the Aquatics section in Chapter 3 of the FEIS. Mountain sucker are known to occur with more prevalence off of the Forest within 5th HUC watersheds, but the reverse is true for Yellowstone cutthroat. Past, present, and reasonably foreseeable cumulative effects that were considered are described in the FEIS Chapter 3 introduction in a table. Cumulative effects of each alternative with these other known and foreseeable activities were summarized through the cumulative effects viability determinations made for each species. The viability determinations are summarized in the biodiversity section of Chapter 3 in the FEIS in the single species analysis portion. The Viability Analysis document in the project record provides further supporting rationale for each determination made.

Cumulative effects over and above the direct and indirect effects mentioned above are minimal on the Forest due to the limited amount of private land within the Forest boundary. There are no known proposals for additional development of any of these lands. State land within the Forest boundary may have additional highway widening, particularly along the Cutler Hill stretch of Highway 14, though impacts to riparian are likely to be minimal due to the current location of this road on sideslopes and ridgetops. Lands adjacent to the Forest are primarily private and/or BLM. Private lands would continue to receive pressure from urban development trends. These adjacent lands would likely continue to receive impacts from livestock grazing and water depletions that are ongoing. These activities should not impact habitat on the Forest, but may increase the value of

riparian habitat on the Forest.

The most significant cumulative impact to riparian habitat and species on the Forest would continue to be from non-native fish, plants, or other species. Stocking practices in the past have been mostly responsible for reducing populations of Yellowstone cutthroat trout, and likely the amphibian species. While this practice may continue in most streams currently stocked, some streams may be treated to remove non-native species in cooperation with the WGFD to improve habitat for YCT. Further potential impacts could occur from whirling disease or other such non-native diseases to both fish and amphibians, as noted in national declines in amphibians. Improvements in beaver distribution, if successful, should provide improved riparian conditions for all species.

With regards to the alternatives considered in the FEIS, those alternatives that would seek to create additional stream crossings associated with roads, and the potential for "lost" riparian habitat would have the most potential for increasing cumulative effects. Non-native species impacts would also potentially increase with additional roading. The following table summarizes how the Forest Plan anticipated effects would cumulatively impact habitat for species in the cumualtive effects area, considered in conjunction with the past, present, and reasonably foreseeable actions as mentioned above.

Table K-4. Relative cumulative impact of alternatives on the riparian associated sensitive species.

Land Use Category	**Less Impact← Relative Impact →More Impact to riparian species**					
Effects from land authorizations	No difference between alternatives					
Effects from motorized recreation mgmt. (potential for user created roads)	C	B	D-DEIS	D-FEIS	A	E
Effects from livestock grazing	No difference between alternatives					
Effects from timber harvesting (tied to road effects)	C	B	D-DEIS	D-FEIS	A	E
Effects from timber harvesting (tied to vegetation management)	C	B	D-DEIS	D-FEIS	A	E
Lands allocated to Management Area category 5 (most active management)	C	B	D-DEIS	D-FEIS	A	E
Suited timber by Alternative	C	B	D-DEIS	D-FEIS	A	E
Effects from prescribed fire	E	A	C	D-DEIS	D-FEIS	B
Effects from wildland fire	E	D-DEIS	D-FEIS	A	B	C
Effects from utility corridors	No difference between alternatives					
Land available for locatable minerals and oil and gas	C	B	D-DEIS	D-FEIS	A	E

The effects above show estimated future disturbance differences between alternatives. Yet, watersheds have been impacted to some extent by past management efforts. A discussion of cumulative effects to watersheds is contained in the Aquatic section of Chapter 3. Compliance with state Best Management Practices will ensure that future management activities under any of the alternatives will continue to protect the riparian resources on the

Forest. Individual species protections would be ensured through preparation of site specific NEPA analysis and Biological Evaluations, with protection offered through forestwide standards and guidelines as described above.

Determinations and Rationale

Based on the above analysis, a determination of ***"may adversely impact individuals but not likely to result in a loss of viability over the planning area nor cause a trend toward listing or a loss of species viability rangewide"*** is made for the following species analyzed in this section for all alternatives:

Yellowstone cutthroat trout	Wood frog
Mountain sucker	Water vole
Northern leopard frog	Harlequin duck
Columbia spotted frog	Leathery grapefern
Mountain lady's slipper	Yellow lady's slipper
Russet cottongrass	Grass-of-Parnassus
Northern blackberry	Lesser bladderpod

There was not a significant enough difference in alternatives to warrant a different determination, as forest-wide standards and guidelines offer a level of protection and mitigation regardless of alternative. A "no impact" determination was not warranted due to the uncertainty of some recreation uses and potential disturbances to species, or unknown species' distributions. While there may be more risk associated with expanded road networks and potential ground disturbance in Alternatives E and A over current levels, these activities would only occur on up to 30% of the forested acres and still leave larger areas in "intact" habitat conditions, and thus not drive habitat to a condition that may cause an eminent threat of listing for these sensitive species. Species that may have a poor viability outcome in the future as described in the FEIS, such as the Yellowstone cutthroat trout, are mostly due to the cumulative effects mentioned above from non-native species, which are not directly a result of Forest Service management activities.

Caves/ Mines/ Cliffs/ Rock Outcrops Habitats

Fringed myotis *(Myotis thysanodes)*

Status and distribution of species: Fringed myotis occur in western North America from southern Canada to Mexico. The species is never abundant, with only a few individuals usually known at a location. Little information is available to assess population or trends, though most Western states list them at less than secure rankings (NatureServe 2003). Due to declines nationally and regionally in populations, state bat working groups have been established in most states, typically chaired by state wildlife agencies. These state groups are a subset of the larger Western Bat Working Group (WBWG) encompassing all 12

western states. These groups have propagated conservation measures and shared and prioritized survey efforts and results. The WBWG also published a matrix of regional priorities to help guide habitat and species-specific conservation efforts (WBWG 1998), and ranked this species as "high". A "high" status indicates a high level of concern for the viability of the species. It is ranked within WY as a G5S2 species.

Population status and distribution on the Bighorn NF: This bat is known from three locations on the Forest, including the Tongue River cave, Cottonwood Canyon, and Tensleep Canyon. From recent surveys conducted in the past five years, this species has not been detected, though surveys were not extensive. From the Cave Inventory for the Bighorn NF (Uhl 1980), and from the WGFD inventory and status sheet for caves on the Forest, there are several areas that could be potential habitat, and several more that have not been evaluated. There is insufficient information to address either its status or distribution on the Forest, but it is assumed that this species could readily distribute to other locales either off of the Forest or on to the Forest.

Habitat status on the Bighorn NF : Fringed myotis are found in a broad range of ecological settings, from grassland to coniferous forest, desert, riparian areas. They share abandoned mines and cave with other bat species, roosting in maternal colonies, male summer colonies, and hibernacula, and may be highly gregarious at these sites. They may also occupy rock crevices and/or snags, presumably in summer months.

Due to the geology of the Big Horns, there are numerous caves, cliffs, and rock outcroppings that provide roosting habitat for many bats, mostly in the limestone and dolomite formations. In addition, the forested areas provide many opportunities for snag or tree/foliage roosting species. The abundant riparian areas and ponds provide prime foraging habitat due to the association of insect abundance and water for drinking by bats. However, both of these elements (rock formations and riparian areas) are limited to their current amount on the Forest, with little ebb and flow of change on the landscape in terms of abundance.

There have been two or more efforts at inventorying caves, sinkholes, and fissures on the Forest. The first is known as Caves of Wyoming (Hill et al 1976), and the second is the cave inventory completed by Uhl (1980). Other publications by speleological societies contain similar information. As mentioned previously, Forest and WGFD employees have also conducted inventories specifically for bats. The WGFD (Grenier 2002) maintains records of all known caves and other sites suitable as bat habitat on the Forest. There are many sites that have not been evaluated for bat potential, largely due to their smaller size than known caves, or due to lack of time and funding to date.

There are four large caves on the east side of the mountain (Tongue, Big Piney, Cliff Dweller's, Eaton's) that have been determined to be significant caves (USDA Forest Service 2002). All of these have had impacts from recreational cavers, though none as significant as Tongue River. Due to the bridge and trail to the cave, high visitation to this site has resulted in extensive graffiti, litter, and dust on cave features due to visitor traffic. As evidenced in survey reports, Tongue River cave has likely lost most of its habitat

suitability. Habitat is suitable, but winter and day roost occupancy is precluded by the high degree of human use and disturbance. Summer records indicate that Tongue River is likely still being used as a summer night roost. It is likely that bats would reoccupy the site as a hibernacula if human disturbance can be reduced. Previous attempts at gating this cave have failed, though the Forest may attempt this again primarily due to safety reasons as demonstrated by the number of search and rescue missions taking place in the cave. Bat species originally seen in 1994 and 1995 may not still use the site. The amount of disturbance year-round to any of these caves has the potential to disrupt and kill bats. Where the USFS controls access to most of the caves, a more aggressive gating endeavor may provide some assurance of future habitat protection for bats. Trends of increased spelunking use have increased in the past decade as populations and mobility of people have increased, with correlated impacts to cave resources and bats. Caves on the west side of the mountain have only just begun to be inventoried, with results indicating that there is much less disturbance in these caves, and there is also likely more potential habitat on the west side.

The Forest has also installed 6 bat houses (Tuttle and Hensley 2001) to attract bats to sites that are easily monitored, resulting in 3 occupied houses, mostly with Townsend's big-eared bats. These type of structures mimic snags or similar features naturally occurring on the Forest. Although snags have been removed by timber sale projects on the Forest, there is no indication that there is a shortage of snags due to the limited amount of areas that timber harvest has occurred in (currently estimated at less than 20% of forested areas), and due to the abundance of mature forest conditions across the Forest. Snags have been known as important roosting habitat for bats in both aspen (Crampton and Barclay 1998), and conifer cover types (Weller and Zabel 2001). Most of the Bighorn continues to progress towards a late seral condition, in both aspen and conifer types. This is largely due to fire suppression, roadless areas, and limited amounts of timber harvest. Although fuelwood harvest occurs throughout the Forest, it typically occurs within 100' to 200' of a road. The loss of aspen is another concern, as this type of habitat provides the most abundant amount of snags on a per acre basis. Loss of aspen is likely due to heavy ungulate browsing (domestic and wild) and lack of disturbance (fire or other types). Though limited naturally in occurrence compared to other areas of the state, aspen on the Forest are in a primarily mature state with strong incidences of diseases.

There are few if any existing abandoned mines on the Forest that have not been previously closed. There were very few that could have provided habitat as the Bighorns have not been a known source of this type of activity.

In summary, caves as a particular feature have had recreational impacts to them, mainly on the east side, but only few with significant impacts. There is no indication that above-ground activities have had negative impacts on cave resources to date. There are many areas of unevaluated or unsurveyed bat potential. No acoustic surveys have been conducted to date on the Forest to document general use of an area by bats.

Threats, limiting factors, vulnerability to Forest Service management activities: As discussed above, recreational caving is likely the largest disturbance to bats, regardless of

season, though few cavers are active in the winter as compared to summer in most caves due to access constraints. Since the Forest can theoretically control access to the caves, the need for gating or otherwise restricting access may become more prevalent depending on the continued upward trend of recreational use of caves.

Rock climbing may also disturb some cliff face areas, where crevices could potentially provide bat habitat. However, the amount of climbing on the Forest is currently quite limited in its extent and abundance, and this is not likely a significant impact.

Removal of snags could also be an impact to potential habitat, as discussed above (Keinath 2004). Given the limited amount of harvesting and fuelwood activities on the Forest, this is likely not significant. Wildfires and prescribed burns could also remove snags, though also they typically create many snags as well. Declined riparian conditions or loss of riparian habitat could also impact potential habitat. As discussed in the riparian section above, this could occur from livestock grazing, recreation use, or road construction in these areas.

There are no wind turbines on the Forest, which have been known to be a source of mortality for some bats. Insecticides are also a known threat to bats, reducing prey populations and potentially resulting in secondary poisoning. As this is not a common practice on the Forest, except in managing facilities, this should not be a threat for consideration. Only passive traps have been used for insect control and research purposes in forested settings. Finally, impoundments of toxic chemicals in ponds have also been known to kill bats, a practice not used on the Forest due to lack of active mining.

It is not thought that either disease or predation is occurring above normal levels for the species that could further exacerbate any known conditions. Variances in prey abundance would also cause a variance in population levels for this species in any given year.

Conservation and protection measures: In addition to measures identified in the Federal Cave Protection Act of 1988, conservation measures were taken largely from the Townsend's big-eared bat species conservation assessment and strategy (Pierson et al 1999), and the Fringed myotis conservation assessment (Keinath 2004). Measures identified in Keinath (2004) and the *Guidelines for Cave and Karst Protection* were also considered (Watson et al 1997). These measures are listed below and should provide beneficial practices to maintain species populations and habitat if implemented. They were considered and written in to Forestwide standards and guidelines where appropriate.

1. Evaluate any abandoned mines prior to closure to determine bat habitat potential or active use. Consider gating as necessary to protect this habitat.
2. For all gating projects, use bat friendly gates as described in Tuttle and Taylor (1994).
3. As prescribed in the Cave Act of 1988, evaluate caves and protect significant caves to provide for bat habitat. Where unacceptable resource damage has the potential to occur, proactively restrict access to recreational caving uses during seasons to benefit bat use. Use the season of April 1st to October 1st for sites known to be used as maternity roosts, and September 15th through May 15th for hibernacula roosts.

4. Follow the measures of the Cave Act of 1988 to protect above-ground and interior resources of caves through proper management of significant caves, and by restricting information on the location and nature of cave resources to the general public. Include opportunities for education of recreation users of caves in development of cave management plans.
5. Cooperate with state and local agencies and private landowners to conserve cave and abandoned mine habitats for bats.
6. Manage riparian and aquatic habitats to maintain and improve vegetative and water quality conditions (Christy and West 1993).
7. Manage for snag abundances, old growth, and mature forested conditions within a range of historic availability of these habitats, with consideration for future availability of this habitat type. Snag abundance and dimensions should mimic those required for avian and other species (8 large snags per acre mentioned in Keinath, 2004).
8. Promote the retention and regeneration of aspen on the landscape.

There were many suggested provisions of inventorying and protecting known roost sites including snags, a practice which is not currently feasible due to the intensive amount of time required to search out these sites. Most known roosts are in caves, which occur in steeper terrain and are therefore highly unlikely to have disturbances such as roads or timber harvests or prescribed burns near them.

Spotted bat *(Euderma maculatum)*

Status and distribution of the species: Spotted bats occur in western North America from southern Canada to Mexico. The species is never abundant, with only a few individuals usually known at a location. Little information is available to assess population or trends, though most Western states list them at less than secure rankings (NatureServe 2003). Due to declines nationally and regionally in populations, state bat working groups have been established in most states, typically chaired by state wildlife agencies. These state groups are a subset of the larger Western Bat Working Group (WBWG) encompassing all 12 western states. These groups have propagated conservation measures and shared and prioritized survey efforts and results. The WBWG also published a matrix of regional priorities to help guide habitat and species-specific conservation efforts (WBWG 1998), and ranked this species as “high”. A “high” status indicates a high level of concern for the viability of the species. It is ranked within WY as a G4S3 species.

Population status and distribution on the Bighorn NF: There have been no sightings of this bat on the Forest, though sightings in similar habiats immediately adjacent to the Forest have occurred. This species is more difficult to detect in common roost surveys, and as such may not have been observed in limited surveys conducted to date. There is insufficient information to address either its status or distribution on the Forest, but it is assumed that this species could readily distribute to other locales either off of the Forest or on to the Forest.

Habitat status on the Bighorn NF: Refer to the discussion above on the fringed myotis. This species is known primarily to inhabit rock crevices, and frequent riparian areas for foraging.

Threats, limiting factors, vulnerability to Forest Service management activities: Refer to the discussion above on the fringed myotis. Recreational caving would likely be less of a threat to this species, though this is also speculative.

Conservation and protection measures: Refer to the discussion above on the fringed myotis.

Townsend's big-eared bat *(Corynrhinus townsendii)*

Status and distribution of species: Townsend's big-eared bats are widespread across the western U.S and portions of Canada and Mexico. They also occur in the eastern U.S. (NatureServe 2003). Across their range, the population may be declining. As described above with the previous two bat species, the Western Bat Working Group considers these a "high" priority species for conservation rank, and their heritage ranking is a G4S2.

Population status and distribution on the Bighorn NF: This bat is known from at least three locations on the Forest, including the Tongue River cave, Cottonwood Canyon, and Spanish Pt. Cave. An observation adjacent to the Forest occurred in Tensleep Canyon. While observations have not occurred recently for Tongue River Cave, other caves appear to be continually occupied by this species. From the Cave Inventory for the Bighorn NF (Uhl 1980), and from the WGFD inventory and status sheet for caves on the Forest, there are several areas that could be potential habitat, and several more that have not been evaluated. There is insufficient information to address either its status or distribution on the Forest, but it is assumed that this species could readily distribute to other locales either off of the Forest or on to the Forest.

Habitat status on the Bighorn NF : Roost sites are in caves and abandoned mines across a broad range of elevation and vegetation types, from dry shrub to coniferous forest. Foraging may occur within the forest canopy and along riparian corridors. The species relies most heavily on moths. Refer to the discussion above for the fringed myotis for habitat status and distribution.

Threats, limiting factors, vulnerability to Forest Service management activities: Refer to the discussion above for the fringed myotis for these issues. In addition, Townsend's bats are considered to be more sensitive to disturbance in abandoned mines and caves and have high site fidelity.

Conservation and protection measures: Refer to the discussion above for the fringed myotis.

Peregrine falcon *(Falco peregrinus anatum)*

Status and distribution of species: After declines to near extinction due to chlorinated hydrocarbon contamination, the species has been recovering. Banning of DDE and related pesticides in the U.S. and a reintroduction program have been successful in restoring the bird. The species has been removed from the Endangered Species List, but are considered as sensitive by the Forest Service to help ensure continued protection and management. In 2002, 60 pairs fledged 97 young in Wyoming. They are considered a G4S2 species in Wyoming (WYNDD 2003). They migrate south in the winter to South America (White et al 2002).

Population status and distribution on the Bighorn NF: Currently, peregrines nest somewhat regularly on or near the Forest in Shell Canyon, Tensleep Canyon, and Big Goose Canyon. Other previously evaluated areas remain as potential habitat that could be occupied in the future. It is estimated that this is a positive trend in species abundance from information available from 1970 to present. They are considered a Wyoming Partners in Flight Level 1 species, noted for conservation action needed (Cerovski et al 2001). They readily disperse both on and off the Forest

Peregrines historically occurred on the Forest, although at largely unkown population levels (Oakleaf 1980). In conjunction with recovery efforts for the species following its listing under the ESA, four hack sites were used on or near the Forest from 1991 – 1995. These sites, including Shell Canyon, Garden of the Gods, Buck Mtn., and Trapper Canyon. were mostly successful. Follow-up surveys by WGFD have occurred somewhat regularly in Shell Canyon, Tensleep Canyon, Buck Mtn., and Big Goose Canyon on or near the Forest (Oakleaf 2001). Other surveys occurred in 1980 and from 1994 – 1999 with negative results in Elk Springs Canyon, Five Springs Canyon., Medicine Wheel, Paintrock Canyon, Little Bighorn River Canyon, Tongue River Canyon, South Fork of Little Tongue River, Wolf Canyon, and Little Goose Canyon. An evaluation of potential habitat was also conducted for the Forest in 1981 (Oakleaf and Gibson), including sites previously mentioned.

Habitat status on the Bighorn NF : Nesting occurs on mountain cliffs and river gorges. Preferred cliffs range from 50m to 200m in height. Home ranges may be typically around 5 square kilometers, or approximately 2,000 acres. Some historic nest sites have been taken over by other raptors (like prairie falcons and golden eagles). Non-breeding birds occur in a range of open country that supports populations of prey (small to middle-sized birds). In migration, peregrines congregate near wetlands where they prey on migrant shorebirds and waterfowl.

None of the known or potential nesting areas have known habitat limitations. Although both Tensleep and Shell Canyons have highways located in them, there have not been any known disturbances from the highways or associated recreational uses, including climbing, to any known nesting sites. No habitat modifications have occurred to the cliffs that would render them less suitable for nesting. Habitat remains as widely distributed and largely as intact as it was the day it was formed.

Threats, limiting factors, vulnerability to Forest Service management activities: As described above for the fringed myotis, disturbance at nest sites by rock climbers or other recreationists can be a factor. However, this is of limited significance, particularly given known nesting locations vs. current climbing activity. Another impact, with no management responsibility by the Forest, is the taking of young by falconers or shooting of raptors.

Predation on fledglings by golden eagles can be a mortality factor, as well as collisions with fences and powerlines, or electrocutions from powerlines. Continued contamination of prey with bioaccumulating pesticides (which are still used within the wintering range of the species) may also be a mortality factor, though not on the Forest.

Conservation and protection measures: Conservation measures applicable to the Forest would include nest site protection from human disturbances (USFWS 2002) and design of power poles to prevent raptor electrocution (APLIC 1996).

The most common source for conservation measures is reliance on the 2002 U.S. Fish and Wildlife Service Guidelines for spatial and temporal buffers for nesting raptors (USFWS 2002). These have been the accepted guidelines from which the Forest has operated in providing desired protections for nesting raptors. It should be noted that these have not been used in the past for peregrines due to the isolated locations that are typically inhabited and the lack of disturbances on the Forest with which to be concerned.

White larchleaf beard-tongue *(Penstemon laricifolius ssp. exilifolius)*

Status and distribution of species: *P. laricifolius ssp. exilifolius* is a regional endemic to Wyoming and Colorado. This species heritage ranking is G4T2QS2 in Wyoming and Colorado, from approximately 1 dozen locations (Nature Serve 2003).

Population status and distribution on the Bighorn NF: This species was discovered on the Forest in June, 2005. It is known to occur immediately adjacent to the Forest. There is no information on the status of the populations on the Forest at the time this BE is being prepared.

Habitat status on the Bighorn NF: In Wyoming, this plant inhabits sparsely vegetated ridges with sagebrush and/or limber pine/ponderosa pine. There is an abundance of this type of habitat on the western slope of the Forest, with relatively few roads through it, due to the remote locations of this type of habitat. Elevation ranges from 7,000 to 9,500 feet. There are many areas of potential habitat that have not been surveyed for this plant. Due to the lack of disturbance to this type of habitat, it is assumed that potential habitat remains largely intact.

Threats, limiting factors, vulnerability to Forest Service management activities: Any ground disturbance would be considered a threat for this species, such as through road or trail construction, or dispersed camping, or salting of livestock. It is not known if this plant requires disturbance to regenerate. In general, this plant is not likely a desirable

forage species by livestock, nor are trails or roads typically built in this type of habitat.

Conservation and protection measures: Conservation measures for *P. laricifolius ssp. exilifolius* would be similar to those described for other plants, in terms of avoidance for ground disturbing activities. With a lack of known populations on the Forest, it is difficult to assess other applicable measures. Currently, the priority for the Forest is locating additional populations to gather baseline data. Known plant populations, according to Revised Plan standards and guidelines, would be protected during management activities conducted by the Forest through the use of design criteria built right into the project.

Wooly twinpod *(Physaria didymocarpa var. lanata)*

Status and distribution of species: *Physaria didymocarpa var. lanata* is a regional endemic to northern Wyoming and southern Montana (Fertig 2000). This species heritage ranking is G5T2S2 in Wyoming, and S1 in Montana. Wooly twinpod has 20 extant occurrences rangewide, and is restricted to the Big Horn Mountains and the adjacent northern Powder River Basin (Heidel and Handley 2004). One population occurs on the Amsden Creek Wildlife Habitat Management Area (WHMA) and another on the Bud Love WHMA, both adjacent to the Forest.

Population status and distribution on the Bighorn NF: There are 4 known locations on the Bighorn NF, two of which have been mapped and censused (Heidel and Handley, 2004). There is no information on the status of the populations on the Forest.

Habitat status on the Bighorn NF: In Wyoming, *Physaria didymocarpa var. lanata* inhabits sparsely vegetated roadcuts and actively eroding slopes and cliffs, and is associated with both Ponderosa pine-juniper scrub and cushion plant communities from 3,600-9,000 feet elevation. It is a short-lived perennial that occupies a stressful environment with low water availability, extreme temperatures, and full exposure to the forces of wind erosion. Eleven of the 14 Wyoming occurrences are found on intermediate foothills from 4,600-7,000 feet elevation. Potential habitat on the Bighorn NF exists at the lower elevations on the eastern slope in bands of Darby Limestone and Bighorn Dolomite and other areas (Heidel and Handley 2002). There are many more areas of potential habitat that have not been surveyed for this species. There are few roads or other disturbances in this low elevation band along the east side of the Forest, so it is presumed that potential habitat remains largely intact for this species.

Threats, limiting factors, vulnerability to Forest Service management activities: Potential threats cited for *P. didymocarpa var. lanata* on the Bighorn NF include road development, herbicide use, concentrated livestock trampling, and concentrated recreation use, but little is known about effects (Heidel and Handley 2004). Coal bed methane and coal mining in adjacent, off-Bighorn NF, habitats are also considered threats. Road cuts may actually increase potential habitat for *Physaria didymocarpa var. lanata*, because the species seems to require exposed substrates on persistently eroding sites. Often the sites are on steep terrain that has little forage potential and limited human activity. Two

examples of this type of site are along US 14, ca. 1 mile above Sand Turn; and on US 16 under the Bighorn Dolomite geologic sign ca. 1 mile east of the Bighorn NF boundary. Both of these sites are actively eroding, sparsely vegetated road-cuts. Highway 16 has recently undergone widening and highway reconstruction, though Highway 14 populations have been in existence since that road reconstruction was done several years ago. The Forest Plan effects analysis shows that more roads will be decommissioned that constructed in the future. The forest has a noxious weed strategy in place that incorporates rare plant safeguards, and the potential applicators on the Bighorn are most qualified in plant identification. The present and future Allotment Management Plan process will include project level biological evaluations that will include survey and management requirements for protecting this, and other, rare species. Finally, recreation use is considered to be a low threat on Bighorn NF *Physaria didymocarpa var. lanata* habitat because of its harsh nature.

Conservation and protection measures: *Physaria didymocarpa var. lanata* is a rare regional endemic known to less than a 100-mile span, with limited habitat potential. Because the taxon can be identified with relative ease, and the habitat is quite obvious, pre-project plant surveys should be very effective in locating populations, and project design can be modified appropriately to conserve this plant. Currently, the priority for the Forest is locating additional populations to gather baseline data. Known plant populations, according to Revised Plan standards and guidelines, would be protected by the project design of management activities conducted by the Forest, with applicable spatial buffers.

Direct, Indirect, and Cumulative Effects on Caves/Mines/Cliffs/Rock Outcrops Habitat and Associated Species

Direct effects from any Forest activities are likely to be minimal or nonexistent to individuals, and minimal to nonexistent for any habitat. This is largely due to the fact that these types of sites are either too remote or too steep for normal management activities such as livestock grazing, mechanized vegetation treatment, prescribed burning, road or trail construction, and most recreation uses. Recreation use can degrade habitat potential in cave environments, and to some extent on cliff faces where climbing occurs if use levels are high. For example, the Tongue River Cave has shown many instances of recreation impacts degrading habitat through graffitti, dirt, litter, and other impacts. There are no known proposals for additional mineral developments, or oil and gas developments, at this time on the Forest that could potentially impact these habitats.

Indirect effects such as disturbance to nesting or roosting individuals could occur, however, largely from recreation uses. Disturbances from other management activities to individuals in these habitats would be rare to nonexistent. Plant species would not likely have any indirect impacts, such as sedimentation, as these sites tend to be isolated from this type of potential impact. As recreation is likely to increase regardless of alternative, there would likely be no difference among alternatives for this type of effect. Should recreational caving continue to increase, Revised Plan standards and guidelines relating to cave habitats and wildlife disturbance would provide protection for these species.

Currently, Tongue River Cave is the only cave exhibiting a high enough level of impacts to indicate reduction in bat use. Other indirect effects could be caused to sub-surface cave features from surface activity, such as wildfire, prescribed fire, and mechanical harvesting or road building. As management induced habitat changes typically do not occur on or above any of the known cave features due to the steep terrain on the faces, these potential impacts are likely non-existent, however direction (forest-wide standard, caves) was added to the Revised Plan to account for this potential impact.

Finally, the spread of noxious weeds or other non-native species are not likely a threat to these type of environments, though possibly more so for the plant species as opposed to the animal species. Alternatives that promote an increase in road construction may have additional potential for weeds to occur near these sites, however currently this is not viewed to be a threat due to the few and isolated known populations of plants or animals in typically non-developable areas.

In general, the **cumulative effects** analysis area considered for this resource includes the Forest and three miles adjacent to its boundary, as rock features and cave systems are known to extend off of the Forest. Past, present, and reasonably foreseeable cumulative effects that were considered are described in the introduction to Chapter 3 in the FEIS in a table. Cumulative effects of each alternative with these other known and foreseeable activities were summarized through the cumulative effects viability determinations made for each species. The viability determinations are summarized in the biodiversity section of Chapter 3 in the FEIS in the single species analysis portion. The Viability Analysis document in the project record provides further supporting rationale for each determination made.

Cumulative effects are minimal on the Forest due to the limited amount of private land within the Forest boundary, and minimal if any development of Forest Service land anticipated in the future. There are no known proposals for additional development of any of these lands. State land within the Forest boundary may have additional highway widening, particularly along the Cutler Hill stretch of Highway 14, though impacts to this habitat type are likely to be minimal due to the current location of this road on sideslopes and ridgetops. Lands adjacent to the Forest are primarily private and/or BLM. Private lands would continue to receive pressure from urban development trends, though perhaps this would likely be minimal in the next planning period within this habitat type. Many cave resources occur adjacent to the Forest, some on private, and some on BLM. Caves on the threshold currently of receiving too much recreation use may become more impacted in the next decade, indicating a need for monitoring of these habitats, and implementation of protection measures if necessary. Some of the caves adjacent to the Forest have received bat-friendly closure gates to mitigate human recreation impact.

The most significant cumulative impact to rock outcrops and cave habitats and species on the Forest would continue to be from non-native species and/or recreation related disturbances. Both potential impacts may increase over time.

With regards to the alternatives considered in the FEIS, those alternatives that would seek to create additional roads, with associated increased recreation use and noxious weed

dispersal, may have the most potential to increase cumulative effects above the past, present, and reasonalby foreseeable activities described in the FEIS. The following table summarizes how the anticipated effects of the alternatives would cumulatively impact habitat and species, considered in conjunction with the past, present, and reasonably foreseeable actions as mentioned above.

Table K-5. Relative cumulative impact of alternatives on the rock, cave, cliff associated sensitive species.

Land Use Category	**Less Impact← Relative Impact →More Impact to cliff/rock/cave species**					
Effects from land authorizations	No difference between alternatives					
Effects from motorized recreation mgmt. (potential for user created roads)	C	B	D-DEIS	D-FEIS	A	E
Effects from livestock grazing	No difference between alternatives					
Effects from timber harvesting (tied to road effects)	C	B	D-DEIS	D-FEIS	A	E
Effects from timber harvesting (tied to vegetation management, potential influence on cave habitats)	C	B	D-DEIS	D-FEIS	A	E
Lands allocated to Management Area category 5 (most active management)	C	B	D-DEIS	D-FEIS	A	E
Suited timber by Alternative	C	B	D-DEIS	D-FEIS	A	E
Effects from prescribed fire	E	A	C	D-DEIS	D-FEIS	B
Effects from wildland fire	E	D-DEIS	D-FEIS	A	B	C
Effects from utility corridors	No difference between alternatives					
Land available for locatable minerals and oil and gas	C	B	D-DEIS	D-FEIS	A	E

The effects above show estimated future disturbance differences between alternatives. Individual species protections would be ensured through preparation of site specific NEPA analysis and Biological Evaluations, with protection offered through forestwide standards and guidelines as described above.

Determinations and Rationale

Based on the above analysis, a determination of ***"may adversely impact individuals but not likely to result in a loss of viability over the planning area nor cause a trend toward listing or a loss of species viability rangewide"*** is made for the following species analyzed in this section for all alternatives:

Fringed myotis	Townsend's big-eared bat
Spotted bat	Peregrine falcon
Wooly twinpod	White larchleaf beard-tongue

There was not a significant enough difference in alternatives to warrant a different determination, as forest-wide standards and guidelines offer a level of protection and mitigation regardless of alternative. A "no impact" determination was not warranted due to the uncertainty of some recreation uses and potential disturbances to species, or unknown species' distributions.

Alpine Tundra Habitat

Wolverine *(Gulo gulo)*

Status and distribution of species: Wolverines occur circumborealy, and are typically classified as old and new world subspecies. In North America, they ranged from Alaska through Canada east to Maine, and south into New York, California, and New Mexico, following boreal forests, though their range is currently thought to be more restricted (Buskirk and Ruggiero 1994). They are associated primarily with alpine tundra and mature boreal forests, and are native to the Forest. They are a G4/S2 species in Wyoming, with a WGFD ranking of NSS3. Rankings indicate its rare occurrence and possibly declining populations. Wolverines were petitioned for listing under the Endangered Species Act in 1994 by the Biodiversity Legal Foundation, but were found to be not warranted for listing by the USFWS in 1995. Wolverines are associated with following carrion of caribou in northern latitudes on the tundra, and may use spruce-fir forests more in southern latitudes as opportunistic carnivores.

Population status and distribution on the Bighorn NF: While distribution maps in Buskirk and Ruggiero (1994) lack recorded observations for the Big Horns, there have been several sightings of wolverines on and surrounding the Forest, some of which were in the 1990's, and one in 2000 (Jahnke and Oakleaf pers. comm.). The current population trend is unknown, as is the historic population levels. There have been reports of individuals seen back to the 1930s. Based on scattered observations separated by several years, it is possible that the Big Horns are used by wandering individuals, but a self-sustaining population may not occur. Wolverines are well known to be a low density, wide ranging species occupying a variety of habitats in search of carrion (Buskirk and Ruggiero

1994). Litter sizes are of 3 – 6, though sexual maturity is at a later age, indicating an inability to quickly respond to favorable environmental conditions. It is assumed that they could occur forest-wide. Attempts at locating wolverines using camera stations in more remote areas for the winters of 2002-2003 and 2003-2004 have failed to detect any wolverines on the Forest. Cameras were placed on both the east and west sides of the Forest in conjunction with WGFD and USDA Wildlife Services (Clucas and Thiele pers. comm. 2004).

Habitat status on the Bighorn NF: Wolverines have most frequently been observed in open meadows on the Forest, though this is based on few sightings and likely associated with sight distances. At least two reports also indicate use of mature conifer habitats. In Alaska, wolverines are known to roam the arctic tundra in search of caribou carrion, feeding opportunistically until completely filled (thus its latin name for glutton). Home ranges in various studies have ranged from 40 square kilometers to 200 square kilometers. (Buskirk and Ruggiero 1994). Known prey include big game, hares, squirrels, porcupines, marmots, beaver, and other small mammals and birds.

Denning habitat is typically described as boulder talus slopes or in coarse woody debris (CWD) in forests (Magoun and Copeland 1998). Females are also known to move young to different den sites. Wolverines are typically construed as secretive, preferring areas with few opportunities for human contact, though incidences of garbage feeding are also known (Buskirk and Ruggiero 1994).

Due to the use of a wide variety of habitats, there is no limiting habitat association (topography or vegetation type) for wolverines. It is assumed that pockets of mature timber with an abundance of CWD is beneficial, along with open areas supporting big game foraging, coupled with boulder fields for denning. As the Forest is naturally diverse, there is representation of all these habitat types. The Forest likely meets a minimum requirement for old growth and CWD, particularly since harvesting activities have only occurred on approximately 20% of the forested acres on the Forest. Management typically alters the mature forest component, though meadows and riparian areas are also used through livestock grazing and some impacts occur from recreation uses. If roadless or wilderness areas are used as default optimum habitat, the Forest has the Cloud Peak wilderness occurring on 17% of the land-base, along with 45% additional roadless areas for a total of 62% of the Forest in this type of classification where human disturbance is minimized. Recreation use in wilderness areas and some roadless areas may still be high in the summer and fall months. Winter snowmobile use may also occur in roadless areas, though not wilderness.

Threats, limiting factors, vulnerability to Forest Service management activities: There is speculation that human development and activity in the Forest may not be compatible with long-term existence of this species. Immatures and males can be found in developed areas when foraging at low elevation in winter, though they may avoid areas with high levels of disturbance (like resorts) and crossing highways. Females seem to be behaviorally limited to denning only in remote areas. Increased recreation use in

wilderness areas could be viewed as a threat, though in the Bighorn NF is most noticed in the summer months.

Females with young in the den are very sensitive to disturbance and will move young to a new den if one party of skiers passes through the cirque where the den is located (Magoun and Copeland 1998). Young are moved to new dens in the absence of human disturbance, so infrequent disturbance is not likely to impair reproduction. However, regular human use of an area in winter does not provide the solitude females select for denning areas.

Abundance of ungulates is near or above historic highs, providing a good supply of winter-killed carrion during the period of denning and rearing young. Fur trapping has historically been a large source of mortality and determination of population trend. Wolverines in Wyoming are currently classified as a nongame mammal with full protection from take, including fur harvest. Mortality from predation by other carnivores is likely a significant limitation on wolverine populations, particularly where wolves and mountain lions may exist. Starvation is likely the major cause of death in adults (Buskirk and Ruggiero 1994). Several mortalities are also reported through road kills. Livestock losses may also provide carrion sources for the wolverine.

It is assumed that road construction and any increase in recreation use in an area may negatively affect habitat potential.

Conservation and protection measures: These measures were considered in development of alternatives and management direction.

The provision for adequate late seral (old growth) forested conditions within a range of likely historical occurrence (structure, abundance, distribution) is one consideration for this species.

Consideration should also be given to a conservative approach to additional road construction, perhaps using the proposed road densities of 2 miles per square mile or greater as a threshold as suggested in the Lynx Conservation Assessment (Ruediger et al 2000). In general, the other measures for lynx as described in the LCAS would presumably benefit wolverines as well. Existing roadless areas and wilderness likely provide suitable habitat, though observations have taken place outside of these areas as well. It may not be beneficial at this point to reduce these areas.

Direct, Indirect, and Cumulative Effects on Alpine Tundra Habitat and Associated Species

Direct effects from any Forest activities are likely to be minimal or nonexistent to individuals, and minimal for any habitat. Livestock grazing and recreation use may continue to impact habitat in tundra, possibly affecting available prey base, though this is speculative. Alpine tundra is not typically slated for other management activities such as prescribed burning, trail construction, or road building. There are no known proposals for additional mineral developments, or oil and gas developments, at this time on the Forest that could potentially impact these habitats. Most of the alpine tundra would remain in

Cloud Peak Wilderness, and Alternatives B, C, and D-FEIS would also protect the Cloud Peak contiguous roadless areas with management category 1 and 3 prescriptions.

Indirect effects such as disturbance to denning individuals could occur, however, largely from recreation uses. Disturbances from other management activities to individuals in these habitats would be rare to nonexistent. Overall, an increase in road densities may allow for an increase in indirect effects of disturbance to denning or other habitat uses. Alternatives E and A would allow for increases in overall road density, with some minimal increase in road density likely in both Alternative D's, followed by minimal likelihood of any increase in overall road densities in Alternatives B and C.

Finally, the spread of noxious weeds or other non-native species are likely a small threat to these type of environments, largely due to elevation and climate. Some treatment of noxious weeds does occur in the wilderness area currently. Weeds are likely imported by recreational livestock use or domestic livestock grazing or wildlife. Alternatives that promote an increase in road construction may have additional potential for weeds to occur near these sites, however currently this is not viewed to be a threat. Additional wilderness designation in Alternative C and D-FEIS could also provide an increase in recreation use in designated sites, as has been observed in other wilderness areas on and off the Forest.

In general, the **cumulative effects** analysis area considered in this BE includes the alpine tundra habitat on the Forest, as there isn't any on adjoining lands, and minimal if any in the rest of the Bighorn Mountains ecosection. Past, present, and reasonably foreseeable cumulative effects that were considered are described in the introduction to Chapter 3 in the FEIS in a table, covering the time period of the next planning period into the future. Cumulative effects of each alternative with these other known and foreseeable activities were summarized through the cumulative effects viability determinations made for each species. The viability determinations are summarized in the biodiversity section of Chapter 3 in the FEIS in the single species analysis portion. The Viability Analysis document in the project record provides further supporting rationale for each determination made.

Cumulative effects are minimal on the Forest due to the limited amount of private land within the Forest boundary, and the fact that almost all alpine tundra habitat is located in the Cloud Peak wilderness. There are no known proposals for additional development of any of the private lands. State land within the Forest boundary may have additional highway widening, particularly along the Cutler Hill stretch of Highway 14, though impacts to alpine tundra are likely to be minimal due to the current location of this road. Traffic volume and highway width on highways across the Forest are not currently thought to be a barrier for this species. Lands adjacent to the Forest are primarily private and/or BLM, and are too low in elevation to be considered tundra. Private lands would continue to receive pressure from urban development trends and increased recreation, however not impacting alpine tundra habitat. Overall, road densities are anticipated to increase on lands adjacent to the Forest.

The most significant cumulative impact to alpine tundra and species on the Forest would continue to be from non-native species and/or recreation related disturbances. Both

potential impacts may increase over time.

With regards to the alternatives considered in the FEIS, those alternatives that would seek to create additional roads, with associated increased recreation use and noxious weed dispersal, may have the most potential to increase cumulative effects above the past, present, and reasonalby foreseeable activities described in the FEIS. The following table summarizes how the anticipated effects from the alternatives would cumulatively impact habitat and species, considered in conjunction with the past, present, and reasonably foreseeable actions as mentioned above.

Table K-6. Relative cumulative impact of alternatives on the alpine tundra associated sensitive species.

Land Use Category	**Less Impact← Relative Impact →More Impact to alpine tundra species**					
Effects from land authorizations	No difference between alternatives					
Effects from motorized recreation mgmt. (potential for user created roads)	C	B	D-DEIS	D-FEIS	A	E
Effects from livestock grazing	No difference between alternatives					
Effects from timber harvesting (tied to road effects)	C	B	D-DEIS	D-FEIS	A	E
Lands allocated to Management Area category 5 (most active management)	C	B	D-DEIS	D-FEIS	A	E
Suited timber by Alternative	C	B	D-DEIS	D-FEIS	A	E
Effects from prescribed fire	E	A	C	D-DEIS	D-FEIS	B
Effects from wildland fire	E	D-DEIS	D-FEIS	A	B	C
Effects from utility corridors	No difference between alternatives					
Land available for locatable minerals and oil and gas	C	B	D-DEIS	D-FEIS	A	E

The effects above show estimated future disturbance differences between alternatives. Individual species protections would be ensured through preparation of site specific NEPA analysis and Biological Evaluations, with protection offered through forestwide standards and guidelines as described above.

Determinations and Rationale

Based on the above analysis, a determination of ***"may adversely impact individuals but not likely to result in a loss of viability over the planning area nor cause a trend toward listing or a loss of species viability rangewide"*** is made for the **wolverine** analyzed in this section for all alternatives. There was not a significant enough difference in alternatives to warrant a different determination, though there is likely some increased risk with alternatives that increase road densities, such as Alternatives E and A, and to a lesser extent, both D's. Elimination of off-road vehicle travel in the Revised Plan will also

provide a reduced level of these type of potential impacts. A "no impact" determination was not warranted due to the uncertainty of some recreation uses and potential disturbances to species, or unknown distributions.

Mature Conifer, Aspen Habitats

American marten *(Martes americana)*

Status and distribution of species: Martens occur circumborealy, though are classified as other species on other continents. In North America, they range from Alaska east to Maine, and south into New York, California, and New Mexico, following boreal forests (Buskirk and Ruggiero 1994). They are associated primarily with mature boreal forests, and are native to the Forest. They are a G5/S1 species in Wyoming, indicating its rare occurrence, though likely insufficient data exist to support any trend data.

Population status and distribution on the Bighorn NF: Marten are known to occur on the Forest in a fairly widespread pattern. The current population trend is unknown, as is the historic population levels. As part of a research project at the Sheridan College, Marion Klaus collected known observations and conducted a literature review to determine limiting habitat components (Klaus 2002) for the Big Horns. Observation sources have included the Wyoming Observation Database maintained by the WGFD, trapper locations obtained by the WGFD (Tim Thomas) and by Klaus' telephone interviews, locations obtained by Beauvais (1997), and other sightings as recorded in the Wyoming Natural Diversity Database (WYNDD) in Laramie, WY (Scholl et al 2002). Refer to the species assessment in the project record to view these locations. Trapping occurs on the Forest, though appears to remove relatively few marten, as only 11 were recorded in the 2000 Furbearer Harvest Report (WGFD 2000). It is currently assumed, based on continued trapping allowance and repeated observations, that marten are a self-sustaining population on the Forest (Welp et al 2000). Though marten have small litters, they have a relatively long life span (Buskirk and Ruggiero 1994).

Due to the geographic isolation of the Bighorn NF, and their limited ability to disperse across non-forested habitats at lower elevations, the marten population here is likely genetically isolated and distinct from other marten populations, though this determination has not been made to its taxonomy yet (Buskirk 2001; Beauvais 2001). This has been raised as a possible viability issue with regards to management of the Forest due to a possible subspecies status that could warrant its listing as a threatened or endangered species should it be found to be in a declining condition. While this consideration merits research, it is largely beyond the Forest's control, assuming that adequate habitat is provided. Marten could be trapped from another population and transported to the Forest for genetic diversity enhancement, should that be necessary as a possible action by the state, however there are risks with this practice as genetic adaptations achieved by marten on this Forest could be lost, or disease elements introduced.

Habitat status on the Bighorn NF: Marten have been observed in talus slopes near the top of Cloud Peak, possibly hunting pika, but are most commonly associated with mature conifer, particularly along streams, with a strong relationship to coarse woody debris (CWD) (Klaus 2002). Due to the abundance of CWD in mature spruce/fir stands as compared to most lodgepole stands, spruce/fir stands are typically considered more valuable habitat and are selected for more frequently by marten in relation to the abundance of this cover type on the landscape (Buskirk 2001). Marten locations are also typically associated near perennial water sources (Buskirk et al 1989). This is assumed to be important as prey are likely more concentrated there, and moister sites are typically more associated with spruce/fir communities. Den sites have been characterized in Wyoming as including rock crevices, snags, squirrel middens, and logs. Three of these components are likely associated to mature conifer conditions and associated prey sources, including red-backed voles and red squirrels (Ruggiero et al 1998). Marten home ranges vary according to habitat availability and prey abundance, with a minimum of 250 acres (Buskirk 2001). Brooms (mistletoe and rust) in trees have also been documented as important resting sites for marten (Parks et al 1997).

Recent studies have indicated that marten are sensitive to the amount of non-forested conditions within a landscape. Concern has been generated over the amount of mature conifer habitat as compared to openings in a landscape, natural or human induced, where openings occupy more than 30% of the landscape (Hargis et al 1999). However, these same studies have also noted that prey abundance can likely have a dramatic effect on marten use of an area given "fragmented" habitats. The Bighorn is a naturally fragmented landscape, with a range of natural openings (non-forested areas) occurring from approximately 21% to 51% over the nine geographic areas, averaging 34% for the Forest as a whole. Currently, it is estimated that less than 5% of the forested areas are in a grass/forb or seedling stage (structural stages 1 and 2), while approximately 60% of the forested areas are in a pole/sapling stage (3), and approximately 35% of the forested areas are in mature classes (4 and 5). It must also be considered that natural disturbances (fire, blowdown, etc.) to the forested habitat occurred over time, temporarily reducing habitat suitability for marten. It is also recognized that long fire intervals accompany the majority of the potential marten habitat, and that fire suppression efforts by the Forest Service have not likely had a significant effect to date.

It has been recognized that timber harvest differs from fire or other natural disturbances in the amount of CWD that is maintained on the site over time (Tinker and Baker 2000; 2001; Buskirk 2001). All of the these combined factors have not been described or researched on the Bighorn relative to the marten, with the exception of work done by Beauvais (1997), who estimated a low density of martens and recommended retention of late seral stage stands for this and other species. Refer to the Biodiversity portion of Chapter 3 in the FEIS for descriptions of current and predicted fragmentation and connectivity of habitat that could have implications for this species.

Recent research on the Black Hills NF resulted in the development of a predictive habitat model for marten (Fecske et al 2002). Similar procedures identified in this model were applied to the Bighorn to identify potential habitat. Refer to the map and explanation of

the modeling process and its results in the species assessment contained in the project record. The initial model results indicated less than 2% of the Forest was found in the highest value habitat (Class 6). Combined with Class 5, there is approximately 16% of the Bighorn NF that meets the high value habitat. Model classes of values 4, 5, and 6 would likely be the most suitable habitat as depicted on the map and its accompanying table. The amounts of habitat classes 4, 5, and 6 may be within the range of what naturally or could historically occur within the riparian areas for the Forest.

Previous efforts had been initiated to model marten habitat effectiveness on the Forest by Jellison and Burcham (1993), though this was never completed.

Another way to examine the potential habitat is to view the tentatively suited acres for timber harvest. Of the 727,240 acres of forested land on the Bighorn NF, approximately 347,519 acres are considered tentatively suited for timber production (where factors of slope and soils allow for suitable regeneration following harvest). This is less than half of the total forested acres, which in conjunction with the mapping exercise conducted, indicates that some of the non-suited lands provide habitat for marten.

It has also been estimated through harvest modeling that there are approximately 25,000 acres of forested land suitable for timber production within 300' of a perennial water source (Refer to the three-stage suitability analysis documents within project record for Alternative E). This indicates that only approximately 3.5% of the forested areas are considered potential habitat for marten within the highest class rankings (within 300' of perennial water). As such, it would be logical that given natural fluctuations in structural stages of stands, that not all of these areas would be in the larger size classes at any one point in time. Rather, there would be diversity in the habitat within the forested riparian area, though also recognizing that these areas are both the best growing and have the longest duration between fire intervals due to the moister regime of the site.

The forest-wide assessment for forested habitat diversity addresses the availability of mature spruce/fir habitats on the Forest (Bornong et al 2002). Out of approximately 236,330 acres of spruce/fir cover type estimated on the Forest, approximately 100,000 acres (42%) is currently in a mature, more closed canopy (4B or 4C) structural stage condition. As this paper described, there is an unknown amount of old growth spruce/fir on the Forest. This would be the most likely habitat tie for this species due to the size and amount of likely snags (nesting habitat) and prey (voles, red squirrels). A large portion of the 4B/4C acres could be considered potential old growth. Refer to the geographic area assessments for graphic displays of mature spruce/fir occurrence across the Forest, and to the FEIS. From these estimated conditions, it is likely that habitat is within a range that naturally occurred on the Forest. The main difference from historic conditions would be the presence of roads and the loss of habitat associated with them, and a reduction in CWD compared to historic levels in areas where several timber harvest entries have been made. As described in the Terrestrial Assessment (Regan et al 2003), harvesting of timber has only occurred on approximately 20% of the forested acres on the Forest, indicating large areas where harvesting influences have not occurred.

Threats, limiting factors, vulnerability to Forest Service management activities: Trapping has historically been a large source of mortality and determination of population trend. It is assumed that the few animals taken (less than 20) annually on the Bighorn have not been causing a decline in the species, or the state (WGFD) would likely more closely regulate the trapping. Higher trapping levels likely occurred historically on the Bighorn. Ease of trapping is known to be of more concern with increased road densities that allow access to prime habitat (Buskirk and Ruggiero 1994).

There are currently no known disease, usually plague or distemper, or predation problems known for marten that are outside of the range of what likely has occurred over time. There is a concern with competition for prey from other carnivores, such as bobcats and coyotes, which may have increased access to high elevation snow areas where marten normally have the adaptive advantage (Welp et al 2000). These two species have also been known to prey upon marten. This competition concern has been similarly generated for lynx, where a potential road density to be considered as significant is 2 miles per square mile or more (Ruediger et al 2000). Higher marten mortality has also been associated with higher road densities and increased vehicle speeds (Buskirk 2001). Current forest-wide road densities are estimated at 1.36 miles per square mile (FEIS Ch. 3 biodiversity).

Genetic insularity of populations may be of concern as mentioned previously. Testing of DNA is occurring on a limited basis by the WGFD, and would likely continue on an opportunistic basis to help determine the genetic differences of the population on the Bighorn.

Commercial timber harvest could be a limiting factor for habitat if conducted on broad enough scales to reduce CWD and/or old growth conditions in the long term. Firewood removal is another activity that reduces snags and CWD. Late-seral forested areas are most critical near perennial water sources (Fecske et al 2002). Livestock and ungulate grazing is not likely a primary driver of habitat, due to the lack of forage in forested sites, and associated reduced levels of livestock grazing in them. Grazing may be of concern where disturbed sites (fire, harvest, etc.) are not adequately regenerated due to browsing or trampling of seedlings (Welp et al 2000).

Conservation and protection measures: As stated above, the provision for an abundance of late seral (old growth) forested conditions within a range of likely historical occurrence (structure, abundance, distribution) is perhaps the best assurance for this species. Larger patches provide greater interior habitat, which appears to benefit marten. Where these areas are located along perennial water sources, even higher value can be placed on these, particularly within areas of known marten occurrence. The 300' riparian biodiversity guideline would be applicable for marten, stressing retention of late seral stages in spruce/fir forests in this zone.

Maintaining adequate habitat in dispersal or less than primary (old growth) areas would also be of benefit to marten. This is provided through management guidelines for snag and CWD retention, applicable for both prescribed burns and timber harvest. Currently, the proper amount of this is unknown, though due to the species' preference for late seral

conditions, a high level is warranted, based on the stand's potential to produce this type of habitat (i.e. difference of spruce/fir to lodgepole).

Retention of some percentage of blowdown areas from salvage harvest would also provide marten the habitat derived from these events. With similar requirements proposed for lynx and three-toed woodpeckers, the Revised Plan guideline for blowdown retention should help in this habitat aspect.

In summary, the following measures were considered during development of alternatives and forest-wide management direction:

- Provisions for old growth conifer within historic range of occurrence for this type of stand structure, particularly in riparian areas with spruce/fir.
- Provision for adequate retention of mature forested areas to promote old growth in the future, and to provide adequate retention of forested areas from being openings.
- Provision for retention of unsalvaged blowdown and fires in some forested areas to maximize CWD available.
- Provision for retention of snags and CWD during vegetation management activities, with the largest sizes having preference.

Northern goshawk *(Accipiter gentilis)*

Status and distribution of species: Goshawks occur in the western and northern United States and into Canada (circumboreal) within North America, Europe and Asia, and are native to the Forest. They are a G5/S2S3 species in Wyoming, indicating its more rare occurrence within the state. Partners In Flight rank them as a Level 1 species, indicating conservation action is needed. They are thought to occur statewide (WGFD 1999). The goshawk has been petitioned for listing under the Endangered Species Act, however they have not been found warranted for listing (USDI 1998). This is largely due to the amount of habitat available, and the increase in observations of the species due to increased survey effort associated with concerns of its rareness.

A species assessment was recently prepared for the Rocky Mountain Region (Kennedy 2003), which was used in preparation of this document.

Population status and distribution on the Bighorn NF: The goshawk likely occurs forest-wide due to potential habitat. Limited surveys have occurred to determine its distribution or abundance on the Forest, as typically surveys have only been conducted in areas where forested vegetation management projects are being planned. Currently, approximately 13 nesting territories are known or suspected to occur as a result of current survey effort, with many more potential territories remaining. Nesting territories do not typically overlap, so a function of density may limit their distribution, as well as larger areas of non-suitable habitat, such as in the Cloud Peak Wilderness above timberline. Goshawks likely migrate off of the Forest in the winter to lower elevations or lower latitudes, though some may remain on the Forest at lower elevations, based on other literature in Wyoming (Squires and Ruggeiro 1996). They are not likely a unique

subspecies on the Forest due to potential emigration and immigration from goshawks throughout the range in the West.

It is difficult to estimate historic abundance or distribution on the Forest. Goshawks have likely never been a target of exploitation by people as they are not a threat to livestock or big game. Some falconry use of the species occurs, however this is not typically of sufficient amount to affect any populations, locally or regionally (Kennedy 2003). Some habitat alterations have occurred, however this is all likely within the range of habitat alterations that occurred from natural disturbances (fire, etc.). Due to the expense of conducting goshawk surveys in potential habitat, it is unlikely that the Forest would conduct many surveys in areas not planned for vegetation manipulation project. As such, baseline information of population trends, abundance, and distribution are not likely over the next planning period, though undoubtedly information will be improved over current levels.

Habitat status on the Bighorn NF: Goshawks are associated with mature conifer and aspen in most of their range, and studies on food habits in the Southern Rocky Mountains (Squires 2000) and nest site characteristics (Squires and Ruggiero 1996) are largely applicable to the Bighorns. However, the goshawk is also known to be adaptable and a forest generalist, and is able to use small patches of mature habitat within a mosaic of a variety of age classes and structures surrounding it (USFWS 1998). Nest site and habitat use on individual Forests such as the Bighorn may be more narrowly defined, however. Foraging habitat is typically in mature stands, with a more open understory, or in meadows or shrub communities adjacent to nesting stands that provide adequate prey (avian and mammalian species). They will typically not use young, dense stands of forested types due to the barriers to flying and lack of prey. Nest sites are typically mature conifer stands with a closed canopy (> 60%), in a stand typically of approximately 30 acres or larger. Nest trees are typically larger trees within the stand. Nests are more often located near the bottom 1/3 of slopes, on northerly aspects, and within ½ mile of water in the intermountain west (Kennedy 2003).

Habitat for goshawks is typically addressed at the home range of the nesting territory scale (6,000 acres), the post-fledging area scale (~420 acres), and the nest area/stand scale (~30 acres). Potential habitat would most likely fall within coniferous forested types and aspen of structural stages 3B, 3C, 4B, 4C, and 5 (where known or identified), with nesting typically taking place on north-facing slopes within 1/2 mile of water. Due to the abundance of this type of potential habitat on the Forest, no mapping effort was made to delineate it. There are approximately 230,000 acres of primary habitat (4B, 4C) on the Forest, which is approximately 32% of all the forested acres. There are variations among the geographic areas with regards to amount and distribution of habitat, with differences particularly evident in the east vs. west side watersheds due to more areas being forested on the east side. Refer to the forest-wide and geographic area assessments of structural diversity in the project record for the displays of this information.

Manipulations to habitat have occurred through timber harvest, prescribed burning, insects and disease, wildfire, and blowdown. Wildfires have affected the most acres, and it is not

likely that most of the potential habitat (mid and high elevation conifer) has missed any fire cycles to be significantly out of a historic range of occurrence for fires, due to the long fire return interval in these areas. Of significant note, areas where goshawks have been discovered prior to timber sales, the areas have remained occupied following harvest, indicating adaptability, and even the possible habitat maintenance of this type of treatment, for known pairs on the Forest. Monitoring of this type has indicated greater than 5-year nesting returns to harvested sites (e.g. Twin Nickel, Cold Springs, Ranger Cr sales). There is not currently thought to be a lack of potential habitat on the Forest, particularly as timber harvest activities have only occurred on approximately 20% of the total forested acres on the Forest (Regan et al 2003).

In terms of habitat connectivity, there are no known discontinuities that would lead to areas not being suitable habitat for goshawk. The Forest is comprised of naturally "fragmented" conditions where meadows and shrublands are interspersed with timber stands. Where large fires have occurred (e.g. Lost Fire) there are large expanses of habitat in currently unsuitable nesting habitat, though each of those watersheds affected also have a strong presence of mature habitat. None of the timber harvests have taken place that affect more than approximately 1,000 acres at a time. No high volume highways or other barriers occur for goshawks. Livestock grazing on the Forest has likely lengthened the fire return interval for many habitat types, which could mean slow changes and lower abundance of some prey types particularly in grassland and shrubland habitats.

Another approach to habitat is to look at the habitat for primary prey species. Red squirrels may be the most prevalent prey species on the Bighorn, for which there is no known lack of abundance or distribution. Other prey that may rely on more coarse woody debris may be more affected through timber harvest than through fires, as coarse woody debris may be retained less over time through harvest than what naturally occurs. However, this is not likely a factor based on the generalist capabilities of this species as it is known to nest in aspen/sagebrush habitats in other areas of its range, and is also able to exploit a variety of prey species. Avian species such as flickers and robins are common in goshawk diets as well, though the Forest has little data on the abundance of these other prey, though they are both considered very common.

Threats, limiting factors, vulnerability to Forest Service management activities: Threats to this species would be similar to those described for marten. Commercial timber harvest and prescribed burning may alter or remove potential nesting habitat, but can also create a variety of structural stage classes for a diversity of habitat conditions. In addition, vegetation treatments, recreation use, or other disturbances could displace individuals from nesting territories during the spring and summer season. Livestock grazing may alter habitat for prey, and also potentially disrupt nesting individuals, though this has not been known or observed on the Forest.

Conservation and protection measures: The most common source for conservation measures is reliance on the 1992 Goshawk Management Recommendations (Reynolds 1992). These have been the accepted guidelines from which the Forest has operated in

providing habitat and desired protections for nesting birds. Variances have occurred regarding sizes of nest areas and post-fledging family areas managed.

In addition, the national forests in Utah conducted a plan amendment to establish new standards and guidelines for goshawk management (USDA Forest Service 2000). Much of this direction was to provide forested conditions within the HRV of habitats, survey direction, snag and coarse-woody debris retention, native plant species, 40% mature stages in the landscape, identifying alternate nest sites, nest site and PFA protection from disturbances (3/1-9/30), nest sites to retain desired characteristics, created opening size limitations in PFAs, provide habitat necessary for prey species, identify potential treatment areas to improve habitat, and provide monitoring requirements.

Patla (1997; 2003 pers. Comm.) recommended retaining 60% mature forested areas in home ranges for habitat purposes. After consideration, with the abundance of mature conditions existing, and the requirement for 10 and 15% old growth by geographic area, with suitable replacement habitat, that this intent would be met, even if total mature habitat ranged between 40-60%. Current configurations of habitat are largely a result of past fires in the late 1800's, as timber harvest has not been a widespread occurrence on the Forest, and this trend would likely continue, depending on the alternative selected.

Spatial and temporal restrictions for protection of nesting pairs have also been described by the US Fish and Wildlife Service (2002). These included a spatial buffer of ½ mile from nests for the period March 1st to August 15th.

Finally, the Wyoming Bird Conservation Plan also contains conservation measures for the species (Cerovski et al 2001). These habitat measures include: a) retention of aspen through regeneration efforts, b) maintaining shrub/grass communities to ensure high densities of prey species, c) maintaining forest stands >50 acres with 70% canopy closure with trees >8" dbh in areas where goshawks occur, d) avoid nest disturbance from April 1st through August 15th.

As goshawks are not dependent on old growth habitats, there have been no specific requirements for amounts or characteristics of this type of habitat. However, it is also likely that these habitats play a role in habitat for this species, and this habitat should be provided.

Flammulated owl *(Otus flammeolus)*

Status and distribution of species: The flammulated owl ranges from southern BC to the mountains of Mexico. It is found in the mountains of the western United States. Unlike many forest owls of the western U.S. that breed in winter, the Flammulated Owl migrates to Mexico, returning to breed in late spring (McCallum 1994). McCallum (1994) considers the flammulated owl to be common and in no danger of extinction. They are a G4/S1?, indicating their unknown status of breeding in the state, though recent records have documented their use of the Black Hills NF and the Medicine Bow NF.

Population status and distribution on the Bighorn NF: Flammulated owl surveys on the Powder River District in 1994 found none of these species (Cerovkski pers. comm.). The one close known sighting occurred northwest of the Forest in the Pryor Mountains. It is considered likely that the owls may inhabit the Forest, however there has been no confirmation, and therefore trend information can also not be determined for this species.

Habitat status on the Bighorn NF: Flammulated owls are secondary cavity nesters selecting primarily ponderosa pine, lodgepole pine, and aspen forests with an abundance of cavities (McCallum 1994). Aspen may be a focal species in Utah, due to the abundance of cavities typical. They generally tend to use a more open forest configuration as compared to the other two owls. Nest trees in other areas have included snags ranging from 15-30" dbh and 30'-90' in height, with cavities typically 15'-50' depending on tree height. They are largely a nocturnal insectivore, feeding primarily on moths and/or grasshoppers.

Low-elevation ponderosa pine forests are less than 4% of the forested acres of the total Forest. Many of these are in a mature condition, and have missed a fire return interval, indicating a more dense undergrowth condition as described in the fire and fuels section of the FEIS in Chapter 3. While there are many large diameter ponderosa pine trees, many of these would be susceptible to broad stand replacement fires, should they occur, due to the undergrowth.

With regard to mature conifer habitat conditions of mid and higher elevation forests, this was discussed in the goshawk section above. There is an abundance of the mature stage, as logging has only occurred on approximately 20% of the forested acres, and only 3-4% of the forested acres have been managed with clearcuts.

Snag inventories have not been conducted on the entire forest, but where they have been done in association with timber sale planning, they exceed the minimum levels established in both the 1985 and revised plan in terms of amount and size. Refer to the forest-wide assessment for forested structural diversity for information on snag existing conditions in the project record-. There are even higher levels of snags available in non-harvested areas due to insects and disease and fires, indicating an abundance available at the forest-wide scale as harvesting activities have occurred on approximately 20% of forested areas.

Less than 1% of the Forest is comprised of aspen. The CVU database is considered generally inaccurate for this cover type, as many acres of aspen have a high degree of conifer encroachment, or are at that stage in their succession. While succession is a natural process, it is also estimated that a majority of the aspen in the Forest is in this state, indicating a lack of fire disturbance due in part to livestock grazing and fire suppression efforts in the past century. Minor amounts (hundreds of acres vs. thousands) of treatment for establishing aspen regeneration (clearcut) in more climax aspen stands has occurred over the past two decades on the Forest, though many of these have not regenerated well due both to livestock and wildlife browsing of stems. In general, many more acres of aspen need treated, both through conifer removal and through regeneration of mature aspen in order to provide a more balanced range of structural stages over the broader forest-wide scale. Climatic changes may also be affecting aspen distribution in the western U.S. High

levels of ungulate browsing, primarily wildlife and livestock, are currently suspected of inhibiting aspen regeneration forest-wide.

Threats, limiting factors, vulnerability to Forest Service management activities: These would be similar to the threats listed for the goshawk above. In addition, livestock grazing may have some effect on prey species, though climate is largely responsible for insect abundance on the Forest in any given year. Fire suppression may be a greater threat for both the ponderosa and aspen forests that this species may prefer, as fire return intervals have largely been missed in both of these stand types and there is a lack of diversity.

Conservation and protection measures: These would be similar to those listed for the goshawk above. The Forest's primary focus would be to determine if this species even occurs on the Forest. In addition, management activities that sought to restore aspen's presence on the landscape, including mature structure stages and/or retaining snags, would be of benefit for this species. Conservation measures are summarized as follows:

- Avoidance of nests where known from disruption would be beneficial.
- Evaluate the level of structural stage diversity within a watershed to provide a balance of age classes and structural diversity.
- Should active owl nests be found, protect the nest site and the appropriate buffer as described in USFWS guidelines (1999). Nest stands of up to 35 acres have been reported for boreal owls (Hayward and Hayward 1993).
- Manage aspen for retention and expansion over current levels.
- Provide adequate abundance and sizes of snags within a watershed, including provisions for retention trees to provide snags in the future.

Boreal owl *(Aegolius funereus)*

Status and distribution of species: Boreal owls are widespread at low density in boreal and subalpine forests across North America. They have a heritage ranking of G5/S2 for its rarity in Wyoming, and the Partners In Flight working group considers them a Level 2 species, indicating monitoring action needed. They have only been surveyed for with low intensity over the past decade in most states, indicating a cursory effort at gathering this information.

Population status and distribution on the Bighorn NF: Boreal owls are known to boreal forests in North America, with the Big Horns forming a portion of the eastern extent of their range in the western U.S. (Hayward and Hayward 1993). The one known sighting on the Bighorn NF occurred in aspen/lodgepole/spruce/fir mixed forest, near Burgess Junction. Surveys for the past several years conducted in the winter have focused largely on the north end of the Forest, with only the one detection mentioned. There is insufficient information to determine population status or distribution.

Habitat status on the Bighorn NF: Boreal owls nest primarily in spruce/fir forests with an abundance of cavities in snags as they are cavity nesters. They feed primarily on red-backed voles, which require high amounts of coarse woody debris on the forest floor for habitat (Hayward and Hayward 1993). Old growth spruce/fir is likely the most valuable habitat type for this species. Where spruce/fir may be adjacent to or mixed with aspen may be preferential habitat due to the abundance of cavities typically found in aspen. Habitat distribution and status for this species would be similar as described for the marten above. The Forest has initiated a nest box program to better determine presence of the species, and its associated habitats.

Threats, limiting factors, vulnerability to Forest Service management activities: Threats and vulnerabilities for this species would be similar to those described for the goshawk and marten above. Owls are not known to be sensitive to road densities in any way. This species is likely more sensitive to removal of snags than the goshawk.

Conservation and protection measures: Conservation measures for this species would be similar to those listed for the goshawk and flammulated owl above.

Three-toed woodpecker *(Picoides tridactylus)*

Status and distribution of species: Three-toed woodpeckers *(Picoides tridactylu*s) are circumboreal, occurring in Europe and Asia in addition to North America. In North America, they range from Alaska east to Maine, and south into New York and Arizona. They are associated primarily with mature boreal forests, and are native to Wyoming. There is no clear pattern of decline or increase based on Breeding Bird Survey or other available data (Wiggins 2004). They are a G5/S3 species in Wyoming, indicating its more rare occurrence. The Partners in Flight ranking for the species is a Level 2 (monitoring).

Population status and distribution on the Bighorn NF: The species is known to occur from multiple observations on the Forest. Refer to the map in the species assessment in the project record. Monitoring initiated in 2002 (RMBO 2005) in the form of point counts yielded some detections, though old growth spruce/fir was not specifically targeted in this sampling regime, and as such the point counts currently would not likely yield information on this species to determine trend. Other observations are known from the Merrill (1997) report, Downing (1990), BBS (Sauer et al 2001), WYNDD (2002), and several local observations.

The species is a primary cavity excavator, and exhibits strong breeding site tenacity (Mirror-pole 2000). The bird remains active throughout the winter. Breeding and nesting takes place in May and June, with birds territorial in a home range from approximately 100 acres down to 1 acre depending on food supply after insect outbreaks or fires. Populations are known to fluctuate based on insect outbreaks.

BBS trend route provides the only known information for this species' population trend. For Wyoming, data has known deficiencies, but indicates an increased trend of approximately 30%. With increased survey efforts, more individuals will likely be found.

Based on the above information historic and current population trends are unknown on the Forest.

Habitat status on the Bighorn NF: Three-toed woodpeckers are associated primarily with mature and old growth spruce-fir forests, though they may also occur in other conifer types. Three-toed woodpeckers are yearlong residents in spruce-fir or lodgepole, or any burned forest. Their reliance on insects inhabiting bark may link them to "overmature" stands (with a high incidence of dying trees that provide habitat for prey), areas of bark-beetle kill, and recently burned stands. They excavate cavities for nesting in snags; in subsequent years, these cavities are used by secondary nesters and by animals using communal winter roosts. Habitat distribution and status for this species would be similar as described for the marten above.

There have also been several medium-large fires in the past few decades that have created short-term habitat for the species, totaling approximately 2000 acres in the spruce/fir cover type. Conversely, there has been active suppression of many fires in the spruce/fir cover type that could have created additional short-term habitat, but this probably also preserved some old growth habitat and opportunities for small scale bug infestations. With the current amount of beetle infestations and mature timber on the Forest, it is likely that habitat is within a historical range that occurred on the Forest, and may be experiencing recent increases due to the drought.

Timber harvest activity has removed some potential habitat, but an abundance of mature conditions and continued levels of spruce-beetle outbreaks also indicate the potential for populations to be within a normal range of occurrence.

Threats, limiting factors, vulnerability to Forest Service management activities: The primary threats are from logging activity (Wiggins 2004). Removal of snags and old forest, and salvage sales reduce the amount and quality of habitat. Fuelwood gathering would also remove potential habitat for the species. The species does not appear to be sensitive to interior forest conditions and/or fragmentation. Prescribed burning and/or wildland fire use would also remove bug killed trees in terms of habitat potential, though it would also create snags and stressed stand conditions leading to increased insect activity.

Conservation and protection measures: Providing old growth habitat over the landscape would be the clearest measure for ensuring the species viability, and the use of uneven aged management for silviculture projects in spruce-fir (Wiggins 2004). Providing areas of potential habitat within the range of what historically occurred would be the most important element. This would include retaining some areas that have been burned or bug killed rather than salvage harvesting all of these type areas. In addition, conservation or protection of snags would also be needed to ensure minimum habitat requirements are still met in treatment areas. Protection from insecticides (broad-scale application) would also be important, though this has not been a practice employed on the Bighorn NF since the early 1980s and earlier. Avoiding the disruptance of active nests during the breeding season would also be of benefit for this species.

Olive-sided flycatcher *(Contopus cooperi)*

Status and distribution of species: The olive-sided flycatcher is a widespread breeding bird in spruce fir forests of Canada, Alaska, and the mountains of the western U.S. The species winters in Central and South America. It is not a species of concern in Wyoming, with a heritage ranking of S3/S4. The cause of the decline in population is not known and may be related to effects on the wintering ground.

Population status and distribution on the Bighorn NF: The species is known to occur from multiple observations on the Forest, however population trend is largely unknown. Monitoring initiated in 2002 in the form of point counts yielded detections and monitoring applicable for this species' trend (RMBO 2005). Five birds were observed on 20 transects (15 points each) conducted in mid-elevation and high-elevation conifer types. Survey transects, since randomly selected, do not adequately sample old growth stands, where this species would be found more readily. Other observations are known from the Merrill (1997) report with more than 50 observations in a two-year period, Downing (1990), Breeding Bird Survey (Sauer et al 2001), and several local observations.

Breeding Bird Survey trend route provides the only known information for this species' population trend. For Wyoming, data has known deficiencies, but indicates a stable trend. At larger scales, a decline is evident. There are too few observations on Forest Breeding Bird Survey routes to determine trend. With increased survey efforts, more individuals will likely be found. Historic vs. current population trend estimates are unknown. As stated above, populations fluctuate naturally in response to prey abundance.

Habitat status on the Bighorn NF: The species is associated with older spruce-fir forest with abundant snags that are used as a perch for flycatching. Olive-sided flycatchers prefer edges and openings with scattered trees. Burned areas support high densities of these flycatchers, as do natural openings around ponds, beaver ponds, and windfall (Altman and Sallabanks 2000).

The species is a migratory breeder. Home ranges are variable based on prey, but may vary from 10 to 50 hectares (25 – 125 acres). The species is associated largely with mature or old growth conifer forests, with a strong association with openings, as the bird typically perches in snags on the edge of openings. Also associated with wooded shores of streams, lakes, rivers, beaver ponds, and bogs where standing dead trees are present (Altman and Sallabanks 2000). Due to the association with snags, openings, and insects, it is often associated with burned forests. Open-cup nests are constructed at the edge of branches typically in mature conifer trees (not snags), ranging from 1 to 30 meters above the ground.

With both the high level of natural fragmentation or interspersion of forests with meadows on the Bighorn, there is naturally a high level of potential habitat for this species. There are no sensitivities to fragmentation currently known for this species on its breeding range (Altman and Sallabanks 2000).

Habitat for this species is likely similar to that described for the three-toed woodpecker and the red squirrel on the Forest. It is assumed that spruce-fir may provide better habitat than

lodgepole due to the increased cover component for nesting sites in spruce and fir trees. Snag abundance on the Forest appears to be above minimal levels in harvested areas, and widespread areas exist with a great abundance of snags due to mature and dying conditions. Refer to the forested forest-wide and geographic area assessments within the project record, and within the FEIS Chapter 3 section for biodiversity. Timber harvest activity has removed some potential habitat, but an abundance of mature conditions and continued levels of snag creation also indicate the potential for habitat to be within a normal range of occurrence.

With the current amount of beetle infestations and mature timber on the Forest, it is likely that habitat is within a historical range that occurred on the Forest, and may be experiencing recent increases due to the drought.

Threats, limiting factors, vulnerability to Forest Service management activities: Lack of burned areas in spruce-fir and lodgepole would remove the pulses in population that historically resulted from the high density and productivity following burns. However, whether the edge created by logging is used in a similar way to edges along bogs, meadows, and other natural openings is not known. Logging and firewood harvest activities may eliminate some snags in site-specific areas. Limitations of insects, disease and fire may restrict the natural creation and regeneration of potential habitat. Regardless, management activities will never be able to fully or even effectively control insect outbreaks, fire, or blowdown, so this type of habitat would be assumed to be provided through time. In addition, it is desirable to have some level of vegetation disturbances that can be mechanically created with openings (small to larger clearcuts or group selection in uneven), providing snags are adjoining these openings, as this flycatcher has shown positive response to various vegetation treatments in conifer forests (Altman and Sallabanks 2000).

There are currently no known disease or predation problems known for populations of these flycatchers that are outside of the range of what likely has occurred over time. Predation typically occurs from other birds on nestlings and/or fledglings. Impacts to wintering habitat are likely the most significant population elements. Pesticide spraying would also limit prey, with possible secondary poisoning effects, though this is not of concern as it is not practiced on the Bighorn.

Conservation and protection measures: These would largely be similar to the three-toed woodpecker. However, it would also be necessary to provide disturbance events, either mechanical or through fire, to create young seral areas near more mature stands with snags.

Lewis' woodpecker *(Melanerpes lewis)*

Status and distribution of species: Lewis' woodpeckers occur in the western U.S. and into the southern portion of Canada in the Rockies. They are associated primarily with low-elevation open-canopy forests (e.g. Ponderosa pine) and low-elevation riparian areas (e.g. mature cottonwood). They shift south in latitude for the winter, though there is a significant amount of overlap with breeding range (Abele et al 2004). They are a G4/S2

species in Wyoming, indicating its more rare occurrence. The Partners in Flight ranking for the species is a Level 2, monitoring (Cerovski et al 2001). BBS trend routes provide the only known information for this species' population trend. There are no trends listed for Wyoming due to a lack of observations. Western states trends indicate a stable trend, though based on fairly scant data. Throughout the U.S., there is a slight trend downward, also based on scant data. It is difficult to estimate current populations versus historic.

Population status and distribution on the Bighorn NF: The species is known to occur from few observations on the Forest, mostly on the fringes of the Forest. Monitoring initiated in 2002 in the form of point counts did not yield any detections of this species, primarily due to its association with low-elevation forests and riparian areas, within which no transects were established (RMBO 2005). No observations on the Forest were recorded in Merrill (1997), while Downing (1990) only indicates observations adjacent to the Forest, no observations were recorded on BBS routes on the Forest (Sauer et al 2001), and WYNDD (2002) had only one observation on the Forest in Shell Canyon.

Populations are known to fluctuate in response to fire, insects, and disease in terms of prey and nesting habitat. There are typically significant increases in populations following fires in primary habitat (Abele et al 2004).

Habitat status on the Bighorn NF: Lewis' woodpeckers are birds of open forest, typically open ponderosa pine, burned forest, and riparian stringers dominated with cottonwood. Other habitat includes open old lodgepole pine and aspen. The furrowed bark on old trees provides sites for storage of winter food. The species nests in snags, using old flicker cavities or natural cavities. It only occasionally excavates its own nest. For a current habitat description, refer to the habitat status of the flammulated owl, which best represents Lewis' habitat on the Forest.

Threats, limiting factors, vulnerability to Forest Service management activities: Fire suppression has reduced the abundance of open-structured ponderosa pine. Removal of snags, firewood harvest, and old forest and post-burn salvage sales can reduce the amount and quality of habitat, however this is not typically a threat on the Forest due to the remote location of most of the habitat. No commercial harvest activities have occurred for the ponderosa pine types on the Forest, as they are not considered suited. Prescribed fire activities could potentially burn some nests or snags, but would also likely create much more additional potential habitat.

Conservation and protection measures: Restore more open-canopy ponderosa pine sites on the landscape. Provide unsalvaged burn areas in this habitat type, and retain snags where firewood and or fuelwood harvest may occur (Abele et al 2004). Conduct livestock grazing and manage streamflows to retain cottonwood galleries and regeneration of cottonwood galleries. In general, the conservation measures would be similar for those listed for the three-toed woodpecker.

Direct, Indirect, and Cumulative Effects on Mature Conifer, Aspen Habitat and Associated Species

Direct effects from Forest management activities are tied primarily to vegetation management activities, including timber harvest and road construction, fuelwood gathering, and prescribed fire. Nesting or denning habitat and sometimes nesting birds or denning animals can be directly removed or altered through these activities, including mature habitat and snags. However, the level of harvest currently planned would only occur on approximately 7% to 30% of the total forested acres, with Alternative C having the least, and E the most. Past harvest activities have occurred on approximately 20% of the total forested acres. The tentatively suitable lands, defined primarily by slope and soil productivity, represent approximately 347,000 acres, or about 50% of the total forested acres. These tentatively suited lands could be described as the best wildlife habitat of the forested acres due to their gentler slope and better productivity, producing habitat of better quality more quickly than other forested acres. Of these tentatively suited lands, Alternative E would allow approximately 90% of the acres to be harvested over time, ranging to about 50% in both Alternative D's and 16% in Alternative C.

Timber harvest modeling also indicates an abundance of mature conditions occurring due to the low level of harvest activities scheduled, as described in the FEIS. Wildfires and prescribed fire have the potential to remove additional mature habitat acres, though prescribed fire would be minimal, and wildfire occurrences (amount and extent) are difficult to estimate. Refer to the FEIS in the fire/fuels section in Chapter 3. With an assumed 10,000 acre fire occurring in the next decade, there would continue to be an abundance of mature stand conditions. Finally, old growth management guidelines were doubled (most conifer types) and tripled (for spruce-fir) for the Revised Plan as compared to the 1985 plan to help ensure that adequate old growth resources remain for species tied to these habitat types. Furthermore, snag and coarse woody debris retention guidelines were improved/increased in the Revised Plan as compared to the 1985 plan. Snags and coarse woody debris would be anticipated to be reduced in the long term on areas where timber harvest occurs routinely (Tinker and Knight 2000; Tinker and Knight 2001), as described above with the range of suited acres by alternative. However minimum habitat requirements should still be met on these areas. In addition, a guideline was added for retention of portions of blowdown or wildfire burned areas for rare species that did not exist in the 1985 plan.

Direct effects may occur to affect individuals or habitat of species through nest removal (particularly small nests not detected during project surveys), however no populations are anticipated to be negatively affected, and habitat should remain adequate to provide for populations. This is due to the limited amount of harvest activity in any alternative as compared to the overall potential habitat. There are no known proposals for additional mineral developments, or oil and gas developments, at this time on the Forest that could potentially impact these habitats.

Aspen habitat improvement has the potential to remove some snags and mature aspen, however there is currently a predominance of this type of habitat. Restoration activities in

the next decade will largely focus on removal of conifer from aspen stands where succession has been uninterrupted through disturbance processes over most of the aspen stands on the Forest.

Indirect effects may occur to potential prey, such as insects or small mammals. If coarse woody debris is reduced, then prey for some owls may be reduced. Insect abundance would not likely be altered for woodpeckers or other species, since their abundance is tied more to climate. All alternatives would likely have increased levels of wildfires due to insects and diseases. Planned harvest activities could reduce some potential wildfires through a reduction in hazardous fuels, however these same activities may also allow more recreation with possible increases in fire starts by people. Protection from disturbances where nests are known is provided for in plan direction (forest-wide guideline).

Recreation activities would not likely measurably impact mature conifer or aspen. Dispersed camping may provide some aspen injury and subsequent disease mortality as these stands are frequented by campers. Snowmobiling or other motorized activities do not typically remove additional habitat due to the difficulty in access.

Indirect effects to species can occur from human disturbance. This has the potential to occur from all activities, including harvest, recreation, livestock grazing, etc. Where increased road densities may occur, particularly in Alternatives A and E, there could be more potential for human disturbance. Both Alternative D's would have a more moderate increase in road density, and Alternatives B and C would have minimal to nonexistent increases in road density.

There should be a concern that only approximately 15,000 forested acres are within SS1 or 2, which is approximately 2% of the total forested acres. This may indicate that there could be a widespread loss or change of existing habitat due to larger wildfires, and a lack of more balanced age class diversity to ensure the balanced distribution of habitat both spatially and temporally. On the average, harvested or burned forested stands require 25 years for new trees to reach a measurable diameter at breast height.

Finally, the spread of noxious weeds or other non-native species are likely a small threat to these type of environments, largely due to elevation and climate. Alternatives that promote an increase in road construction may have additional potential for weeds to occur in openings within forested stands, possibly altering native vegetation and delaying stand regeneration.

In general, the **cumulative effects** analysis area considered for this resource includes the Forest and one mile adjacent to its boundary. While the Bighorn Mountains ecosection includes additional forested habitat, most of it transitions to lower elevation dependent vegetation (ponderosa pine and douglas-fir and juniper). Past, present, and reasonably foreseeable cumulative effects that were considered are described in the introduction to Chapter 3 in the FEIS in a table. Cumulative effects of each alternative with these other known and foreseeable activities were summarized through the cumulative effects viability determinations made for each species. The viability determinations are summarized in the biodiversity section of Chapter 3 in the FEIS in the single species analysis portion. The

Viability Analysis document in the project record provides further supporting rationale for each determination made.

Cumulative effects are minimal on the Forest due to the limited amount of private land within the Forest boundary, and minimal if any development of Forest Service land anticipated in the future. There are no known proposals for additional development of any of these lands. State land within the Forest boundary may have additional highway widening, particularly along the Cutler Hill stretch of Highway 14, though impacts to mature conifer are likely to be small (less than 100 acres "lost") due to the current location of this road on sideslopes and ridgetops. Lands adjacent to the Forest are primarily private and/or BLM. Private lands would continue to receive pressure from urban development trends. Some of these development sites, such as along the southeast corner of the Forest, have been in mature conifer habitat types. These activities should not impact habitat on the Forest, but may increase the value of mature conifer habitat on the Forest. Overall, road densities are anticipated to increase on lands adjacent to the Forest. These combined disturbances may also reduce mature conifer habitat. However, it is estimated that this loss is minimal when looking at the overall forested acres in the cumulative effects area of the Forest and lands within 3 miles of it. This is primarily due to the fact that most of the land surrounding the Forest is non-forested.

The most significant cumulative impact to mature conifer habitat and species on the Forest would continue to be from natural disturbance processes and timber harvest. While variations in the amount of mature conifer are anticipated to fluctuate naturally on the Forest due to disturbances, there is also the anticipated effect from timber harvest.

With regards to the alternatives considered in the FEIS, those alternatives that would seek to create additional disturbances associated with roads, and the potential for "lost" habitat would have the most potential for increasing cumulative effects. Non-native species impacts would also potentially increase with additional roading. The following table summarizes how the alternatives would cumulatively impact habitat in species, considered in conjunction with the past, present, and reasonably foreseeable actions as mentioned above.

Table K-7. Relative cumulative impact of alternatives on the mature conifer associated sensitive species.

Land Use Category	**Less Impact← Relative Impact →More Impact to mature conifer associated species**					
Effects from land authorizations	No difference between alternatives					
Effects from motorized recreation mgmt. (potential for user created roads)	C	B	D-DEIS	D-FEIS	A	E
Effects from livestock grazing	No difference between alternatives					
Effects from timber harvesting (tied to road effects)	C	B	D-DEIS	D-FEIS	A	E

Land Use Category	Less Impact← Relative Impact →More Impact to mature conifer associated species					
Effects from timber harvesting (tied to vegetation management)	C	B	D-DEIS	D-FEIS	A	E
Lands allocated to Management Area category 5 (most active management)	C	B	D-DEIS	D-FEIS	A	E
Suited timber by Alternative	C	B	D-DEIS	D-FEIS	A	E
Effects from prescribed fire	E	A	C	D-DEIS	D-FEIS	B
Effects from wildland fire	E	D-DEIS	D-FEIS	A	B	C
Effects from utility corridors	No difference between alternatives					
Land available for locatable minerals and oil and gas	C	B	D-DEIS	D-FEIS	A	E

The effects above show estimated future disturbance differences between alternatives. Individual species protections would be ensured through preparation of site specific NEPA analysis and Biological Evaluations, with protection offered through forestwide standards and guidelines as described above. It should be remembered that even Alternative E only prescribes the management of approximately 30% of the forested acres, leaving more than 70% to be dominated by natural processes.

Determinations and Rationale

Based on the above analysis, a determination of ***"may adversely impact individuals but not likely to result in a loss of viability over the planning area nor cause a trend toward listing or a loss of species viability rangewide"*** is made for the following species analyzed in this section for all alternatives:

American marten
Northern goshawk
Flammulated owl
Boreal owl
Three-toed woodpecker
Olive-sided flycatcher
Lewis' woodpecker

There was not a significant enough difference in alternatives to warrant a different determination, though there is likely some increased risk with alternatives that increase timber harvest and road densities, such as Alternatives E and A, and to a lesser extent both D's. A "no impact" determination was not warranted due to the uncertainty of some harvest activities and recreation uses and potential disturbances to species, or unknown species' distributions.

Grassland, Sagebrush/Shrub Steppe Habitats

Northern harrier *(Circus cyaneus)*

Status and Distribution of species: Harriers occur throughout North and Central America, as well as in Europe and Asia, and are native to the Forest. They are a G5/S4S5 species in Wyoming, indicating its more common occurrence within the state. Wyoming Partners In Flight ranks them as a Level 3 species, indicating local area importance, but not of conservation concern per se. They are thought to occur largely statewide, and Wyoming is considered in its year-round range (WGFD 1999; MacWhirter and Bildstein 1996). The BBS monitoring effort indicates stable trend for this species in Wyoming, though with known data deficiencies, and slight downward trends for the western BBS region, also with known deficiencies. Due to its detection only once on one of the BBS routes on the Forest, no trend information is available for the Forest through the BBS effort.

Population status and distribution on the Bighorn NF: It is known to occur on the Forest (Downing 1990) ranging from higher elevations in Cloud Peak Wilderness, to lower elevation meadows. A total of 6 observations occurred on the Forest through the research project conducted by Merrill (1997). It is known from observations by Forest personnel to occur in many meadow systems, typically seen around the Burgess Junction area and other sites, forest-wide. Three detections were made in avian point count surveys conducted during the 2004 field season (RMBO 2005). These point counts occur annually in 10 transects for the grassland/sagebrush type on the Forest. No formal surveys of nesting sites or habitat use have occurred for this species, as it was previously regarded as common and not sensitive, and still fits this classification for Wyoming, though retained on the Region's sensitive list.

It is difficult to estimate historic abundance or distribution on the Forest. Harriers have likely never been a target of exploitation by people as they are not a threat to livestock or big game. Some falconry use of the species occurs, although this is not though to affect populations, locally or regionally. Baseline information of population trends, abundance, and distribution are not likely over the next planning period, due to the lower level of concern with this species as compared to other sensitive species.

Harriers are readily able to disperse as they are an avian species. Both long and short distance migrations are known to occur in other populations that have been studied.

Habitat status on the Bighorn NF: Harriers are ground nesters, usually in tall, dense clumps of vegetation. Habitats include open wetlands and marshes, upland prairies and desert scrub, and riparian woodlands. In drier areas, such as the high elevation grasslands of the Forest, it likely selects for riparian conditions for the taller vegetation. It forages on the wing, capturing mainly small and medium sized mammals and birds. Home ranges may vary from 400 acres to 37,500 acres, depending on prey supply. Territoriality is generally with minimal aggressiveness, and typically only directed at conspecific species. They have relatively low fidelity (30-40%) to previously used breeding territories, indicating their flexibility at using new breeding sites in response to vegetation changes (Macwhirter and Bildstein 1996).

Meadow, shrubland, and riparian systems are widely distributed throughout the Forest, occurring largely in association with soil types, and are naturally fragmented among forested cover types due to this soil association. For this species, meadow/grasslands will be the primary focus of habitat analysis.

Habitat condition on the Forest, including riparian areas, is likely not at its potential in terms of ground cover and species composition, largely due to past livestock grazing, and to a lesser extent, current livestock grazing practices. Grasslands comprise approximately 18%, or 200,000 acres, of the total Forest acres. In any given year, livestock grazing to meeting standards and guidelines established in the Forest Plan may occur on approximately 50% or more of the Forest. Maintaining areas of dense and/or tall vegetation as the grazing season progresses becomes more of a concern. However, from a nesting standpoint, there is sufficient nesting habitat at any one time due to the predominant use of rotational livestock grazing systems, including deferment and rest. Livestock grazing on the Forest has likely lengthened the fire return interval for many habitat types, which could result in slow changes and lower abundance of some prey types particularly in grassland and shrubland habitats.

Threats, limiting factors, vulnerability to Forest Service management activities: Over-grazing may reduce conditions supporting adequate levels of prey, and associated nesting habitat. Maintaining areas with dense and tall vegetative cover on the landscape is desirable for grassland areas, though it is unknown what percent of a given landscape should be maintained in this fashion. Trampling of nests and or disturbance during the breeding season is considered a possibility, though likely rare. The most likely range-wide impact to habitat is from loss of wetlands or open space (MacWhirter and Bildstein 1996).

Wildfires and/or prescribed burning may temporarily reduce (one or more seasons) potential nesting habitat, however both are, or mimic, natural processes responsible for rejuvenation of grassland habitats, resulting in maintenance of habitat over the long term. In general, burning occurs somewhat irregularly in these habitat types on the Forest, sometimes due to a lack of fuel from grazing. When sagebrush sites are burned, more habitat could be temporarily created for this species. Similarly, burning or removing conifer encroachment into meadows would also maintain habitat for this species. Prescribed burning should be avoided for main nesting seasons, including May – July, where feasible. It is also noted that prescribed burning typically impacts few acres of this habitat type in any given year, regardless of season of burn. Where nesting occurs, recreation or other human uses may cause nesting disruptions, (USFWS 2002).

It is not thought that either disease or predation is occurring above normal levels for the species. Since the species is a ground-nester, predation is often a higher cause of mortality. Variances in prey abundance are known to cause variances in population levels for this species in any given year. Shooting, vehicle collisions, predation and starvation are known to be mortality factors (Macwhirter and Bildstein 1996). Electrocution from powerlines was not mentioned as a factor for this species.

Conservation and protection measures: In general, conservation measures considered in the development of alternatives and forest-wide management direction included:

1. Provide grassland habitats with areas of high, dense vegetation during the breeding season (May – July), up to 40% of the areas in any given watershed.
2. Avoid conducting widespread or large prescribed burns in several watersheds in any given year during the breeding season.
3. Protect known nesting sites from human disturbances (USFWS 2002).
4. Avoid habitat loss of grassland systems through permanent road construction.
5. Require raptor-safe construction standards for powerlines (APLIC 1996).

Short-eared owl *(Asio flammeus)*

Status and distribution of species: This owl is one of the world's most widely distributed owls, occurring throughout North America, South America, Pacific Islands, Asia and Europe (Holt and Leasure 1993). It moves south in the U.S. for wintering grounds, though there is great variation in its movements and overlap with breeding range. It is considered a G5/S2 species in Wyoming, and is listed as a bird of concern by WYNDD (2003), indicating its rare occurrence and potential concern for the species. It is also considered as a Level 1 (conservation action) species by the Partners In Flight working group (Cerovski et al 2001). The BBS trend estimates (Sauer et al 2001) for this species indicate an upward trend in Wyoming, though a slightly downward trend in western U.S. and throughout the U.S., with known limitations with the data. Regionally, there may be localized declines (Wiggins 2004).

Population status and distribution on the Bighorn NF: There are observations from the northeast corner of the Forest in the Little Bighorn drainage, and in the southeast corner of the Forest in the Powder River and Doyle Creek areas, as recorded in the WYNDD and WYOBS databases (2002). These may be breeding observations. No observations have occurred in Merrill (1997), or in the BBS routes on the Forest (Sauer et al 2001). Downing (1990) considers them uncommon residents in open habitats on the Forest.

Historic populations, in terms of distribution or abundance, are unknown for this species on the Forest. Owls have natural variations in abundance due to climate related factors in prey abundance (e.g. small mammals). Dispersal into new habitats can be high due to their flight capability.

Avian point count monitoring transects were initiated in 2002, with the objective of obtaining population trend information after several years of baseline information have been collected (RMBO 2005). 10 randomly selected transects are being conducted forest-wide that would provide information on species in sagebrush/grass habitats. 15 point count stations occur in each transect, separated by 250m. There were no observations of this species 2002-2004, and surveys may not detect them due to timing and methods compared to the behavior patterns of the owls.

Habitat status on the Bighorn NF: Short-eared owls prey on small mammals, such as voles, and may hunt day or night. Based on the fluctuation of vole populations, nesting home ranges may expand or contract, typically requiring areas of at least 5 ha (12.5 acres). It nests on the ground, making it susceptible to predation. It may use areas with denser, taller ground vegetation (> 1' in height), and may preferentially use mounds or other elevated features (Holt and Leasure 1993). They are probably mostly tied with open grassland habitat, but also likely use the sagebrush/grassland intermixed habitats as well.

The grassland habitat type on the Forest is naturally fragmented among the timber and other cover types. It represents approximately 18% of the entire National Forest, and occurs from low elevation to high elevation sites in the Cloud Peak wilderness. Grasslands in general are typically grazed throughout the Forest, as are sagebrush/grassland sites. There are no reliable estimates on what percent of the grasslands on the Forest are meeting their desired condition in terms of species composition or cover. Typically, upland sites are grazed by livestock and wildlife more lightly than riparian grass/forb sites. In general, there is more potential habitat on the west side of the Forest due to a natural prevalence of this type of habitat.

At the forest-wide scale, approximately 50,000 acres of sagebrush community types comprise the 1,105,000 acres of the Forest (4% of total). Most of this occurs on the west side of the Forest. Most of the sagebrush stands on the Forest are in a mature condition, with canopy covers >25%. This is largely due to the fact that fire suppression has been actively employed since at least the 1960's, causing many areas to miss one or two fire cycles, if not more. This condition varies locally, as some projects in the past two decades have sought to add age class diversity into the sagebrush community, such as prescribed burning projects in Shell Canyon. Mature canopy cover may not be as desirable for this owl as compared to the sage grouse or Brewer's sparrow.

Roads or other management activities may displace the species, particularly in a loss of habitat from new construction (Ingelfinger 2001). Many roads have been constructed in the sage/grass community types on the Forest due primarily to ease of construction.

Livestock grazing can also influence grassland and sagebrush ecosystems, and typically results in a greater abundance of mature sagebrush due to the removal of understory herbaceous vegetation. Trampling of nests is likely very rare, despite the species' nesting habitat (ground). Livestock may also exacerbate the introduction of noxious weeds.

Noxious weeds are currently limited to localized concentrations, and cheatgrass has not made invasions of large or broad proportions on the Forest. Neither of these effects, which are typically of large concern in other areas, have not manifested themselves with similar levels of concern. They are not anticipated to increase dramatically either due to existing control mechanisms or climate and elevation related control factors.

In summary, there does not appear to be a lack of habitat (grassland or sagebrush) for this species. Existing extent of habitat is likely similar to what historically occurred, as this is largely based on soil types. Concern may exist on the Forest and adjacent to it with the lack of taller grass that provides habitat for prey and nesting owls. Also of concern may be

the unbalanced proportion of mature sagebrush canopies in most of these habitats. In general, habitat has likely improved greatly over the past decades because of improved livestock grazing management.

Threats, limiting factors, vulnerability to Forest Service management activities: Short-eared owls likely have low fidelity to reuse a nesting site. However, they often do not flush until human disturbance or a predator is very close (< 15') to a nest (Holt and Leasure 1993). Once flushed, they may abandon the nest. Range-wide there may be a loss of habitat from development (Wiggins 2004).

Ground-disturbing activities or vegetation treatments such as prescribed fire in potential nesting habitat during the breeding season could be a risk to this species. Trampling from ungulates (domestic and wild) is likely of low concern. Excessive (more than approximately 50% of annual height) removal of grass through grazing could limit potential nesting cover.

Conservation and protection measures: The following considerations were made in development of forest-wide management direction: Limit livestock grazing to seasons, rotations, and forage use levels that ensure some areas of adequate nesting cover remain. Limit loss of potential habitat by minimizing any road construction in sagebrush/grass habitats. Manage to restrict the spread of noxious weeds that could overtake potential habitat and change both nesting components and prey species composition.

The threat of conversion of habitat to agriculture or residential development does not exist on National Forest land.

Loggerhead shrike *(Lanius ludovicianus)*

Status and distribution of species: This shrike occurs only in North America, known from all but a few eastern states in the lower 48 in the U.S., and known only to three south-central provinces in Canada. Northern populations, including Wyoming, are somewhat migratory, with the species wintering as far south as southern Mexico, though with large areas considered as year round habitat throughout the southern U.S. (Yosef 1996).

Shrikes wintering in Wyoming, north of Casper, are generally considered Northern Shrikes, while the summer range for northern Wyoming is likely the Loggerhead shrike. It is a G4 S3 species in Wyoming, and is listed as a bird of concern by WYNDD (2003). It is also considered as a Level 2 (monitoring) species by the Partners In Flight working group (Cerovski et al 2001). The BBS trend estimates (Sauer et al 2001) for this species indicate a downward trend in Wyoming, with better data confidence compared to other sensitive species. Its range has remained constant, but the numbers of birds are declining (Wiggins 2004).

Population status and distribution on the Bighorn NF: Neither BBS results nor surveys done by Merrill (1997) nor Beels (1996) detected this species on the Forest. They primarily inhabit lower elevation grasslands along the fringes of the Forest as known from WYOBS and WYNDD (2002), and Downing (1990) records one bird in the Burgess Junction area.

Historic populations, in terms of distribution or abundance, are unknown for this species on the Forest. There are natural variations in abundance due to climate related factors in prey abundance (e.g. insects and small mammals). Dispersal into new habitats can be high due to their flight capability.

Avian point count monitoring transects were initiated in 2002, with the objective of obtaining population trend information after several years of baseline information have been collected (RMBO 2005). 10 randomly selected transects are being conducted forest-wide that would provide information on species in sagebrush/grass habitats. 15 point count stations occur in each transect, separated by 250m. There were no observations of this species in 2002 - 2004, and surveys may not detect them due to their limited distribution and lack of grassland monitoring sites on the northeast corner of the Forest where most have been sighted in the past.

Habitat status on the Bighorn NF: Loggerhead shrikes depend largely on insects, reptiles, amphibians, other birds, and small mammals, such as voles and mice. They could be considered a raptor due to feeding habits. Open landscapes interspersed with patchy shrubs and or low trees are the most preferred habitat components. Its unique habit of skewering prey to barbed-wire fences or thorny shrubs also indicates its habitat preferences. Nesting territories range from 3 to 24 hectares (7 – 60 acres), and are aggressively defended. Nests are most often placed in thorny shrubs or in branches of short, thickly branched trees.

Potential habitats on the Forest would include mountain shrub communities, sagebrush, and grassland types. The sagebrush and mountain shrub communities are mostly in a mature condition in terms of canopy cover due to a lack of fire.

Refer to the Brewer's sparrow assessment for a discussion of sagebrush habitats, and refer to the short-eared owl assessment for a discussion of grassland habitats. Mountain shrub habitats make up approximately 3% of the total acres of the Forest, and are mostly distributed on the lower elevation fringes of the Forest.

Threats, limiting factors, vulnerability to Forest Service management activities: Across the species' range, conversion of breeding habitat to agricultural use is suspected as the main cause of the sharp decline. On the Forest and within the Region, livestock grazing and prescribed burning are the two main activities that have the potential to affect habitat (Wiggins 2004).

Shrikes likely have a relatively high fidelity to nesting sites, and are aggressive re-nesters if nests are lost or disturbed. They are thought to be generally tolerant of nesting disturbance by people, though the earlier the stage of nesting, the more likely that more losses would occur (Yosef 1996).

Although fences (barbed wire) are used as prey plucking/cache sites, an increase in barbed wire fences could also mean increased collision with associated mortality (Yosef 1996).

Any permanent habitat losses, such as through road construction, would not be desirable for this species' habitat. As mentioned previously, activities that have potential to expand

cheatgrass or noxious weeds should be closely monitored to ensure further loss of habitat does not occur. Prescribed burning in known cheatgrass or weed patches should not occur. Prescribed burning would likely maintain some habitat characteristics through its mimicking natural disturbance processes.

Predation may be occurring above normal or historic levels due to feral cats, and expansion in ranges of some carnivores. Predation also occurs from raptors and corvids. It is not thought that disease is occurring above normal levels for the species that could further exacerbate any known conditions. Variances in prey abundance would also cause a variance in population levels for this species in any given year. Impacts from shooting are not thought to be large, though historically they were, and pesticide impacts may be related to this species, though nonexistent on the Forest. Collisions with fences and vehicles are larger sources of mortality for this species as well, since it favors roadside habitats due to ease of prey capture (Yosef 1996).

Conservation and protection measures: Conservation measures summarized from the species assessment include the following that were considered in development of alternatives and forest-wide management direction:

1. Prescribed burns should not occur in weed or cheatgrass infested areas.
2. Maintain native grasses, forbs and shrubs through proper grazing limitations. Use rotational grazing systems to provide rest and areas with reduced potential for cowbird parasitism and to provide areas with residual cover in grasses. Provide for retention of approximately 50% of current year's growth of herbaceous vegetation for nesting cover in the following season. Rest burned areas from grazing to provide adequate regeneration of native vegetation. Control non-native vegetation (weeds and cheatgrass) to prevent additional loss of sagebrush habitats.
3. Limit number of new roads; reclaim old ones not being used. Discourage road construction and other developments where it would reduce habitat patch size.
4. Retain sagebrush and mountain brush habitats (no type conversions).
5. Provide escape ramps at livestock water facilities.
6. Maintain water abundance and associated vegetation at springs and seeps.
7. Provide a mosaic of open (5%) to moderate (25%) shrub canopy cover on the landscape.

Brewer's sparrow *(Spizella breweri)*

Status and distribution of species: Brewer's sparrows are widespread in the intermountain West and Great Basin. The species population is declining nationwide, most likely related to loss of habitat (Holmes and Johnson 2005). Regionally, at the state level, the trend is down approximately 2% (Sauer et al 2001). Both results are known to have data limitations. This species is categorized as a G5/S3 species through the natural heritage program ranking, is considered a Level I priority species (conservation action) by

Wyoming Partners In Flight, and is a Forest Service sensitive species. These rankings indicate some degree of rarity or concern. Brewer's sparrows are a migratory species, wintering in the southwest US and north-central Mexico. They do not appear to have elevation limits in their breeding range.

Population status and distribution on the Bighorn NF: They occur forest-wide as documented in most of the known survey publications including the two routes of Breeding Bird Survey results (Sauer et al 2001), Merrill (1997), Downing (1990), Wyoming Observation Database (2002), Beels (1996), and RMBO (2005). They are one of the more common avian species found in sagebrush habitats in Wyoming (Ingelfinger 2001). There are currently no known population estimates or trends for the species on the Forest, which can exhibit fluctuations depending on insect populations and habitat and climate related functions. Initial estimates from the monitoring conducted by RMBO indicates a mostly stable trend over the first three years (RMBO 2005). Breeding Bird Survey trends indicate a downward trend on both the Bald Mt. and Crazy Woman routes.

Beginning in 2002, avian point count monitoring transects were begun, with the goal of obtaining population trend information after several years of baseline information have been collected (RMBO 2005). More than 50 observations were collected through this effort in 2002.

With fluctuations in natural ranges of habitat, it is difficult to determine if populations on the Forest are similar to historic levels or not. Regional declines reported in BBS results for most of the West indicate they are not (Paige and Ritter 1999), and significant acreages of sagebrush habitat have been lost throughout the West due to European settlement influences, such as conversion to agriculture, urban development, or losses due to cheatgrass invasion. These changes are likely having an effect on Brewer's sparrow populations, though these effects currently are not occurring to a significant extent on the Forest as compared to lands surrounding it.

Habitat status on the Bighorn NF: Brewer's sparrows are dependent mostly on sagebrush habitats, tending towards the more mature stands in terms of age class, and larger stand sizes (Paige and Ritter 1999). Food sources are primarily insects in the summer, with seeds of grasses and shrubs a secondary source. Nests are typically constructed in the bottom portion of sagebrush plants, typically in the taller shrubs. Territories may be found far from open water because the birds obtain necessary water from food (insects in the summer).

Refer to the previous habitat status description mentioned for the short-eared owl for this description. As Brewer's sparrows are tied to sagebrush habitat, the Forest has estimates of this type of habitat by geographic area. However, there is only site-specific data being generated with regards to canopy cover of sagebrush, primarily through aerial photo interpretation and ocular estimates (e.g. Southwest fuels project).

In 2002, a mapping effort was initiated to identify where prescribed burns have occurred on the Forest, so that a coordinated effort in planning prescribed burns could be achieved

in conjunction with the Wyoming Game and Fish and the BLM. This effort did not attempt to establish amounts or extent of different age classes of stands of sagebrush.

Roads or other management activities may displace the species, particularly in a loss of habitat from new construction (Ingelfinger 2001). Many roads have been constructed in the sage/grass community types on the Forest due primarily to ease of construction.

Threats, limiting factors, vulnerability to Forest Service management activities: Reduction of sagebrush by conversion to agriculture or loss to cheatgrass and noxious weeds, and alteration in habitat structure (thinning and burning to promote livestock forage) has affected the Brewer's Sparrow across much of its range in the United States.

Nest disturbances can occur from management activities including livestock grazing, recreation management, prescribed burning, and special use programs. Most prescribed burning on the Forest is conducted prior to nesting season or after. Livestock grazing is typically done on a rotational basis, and potential impacts from either nest disturbance or cowbird parasitism associated with livestock distributions are minimized from this approach. Livestock grazing may also influence the condition of sagebrush habitats, though typically in the understory in terms of forbs and grasses. Grazing may help create or maintain more dense canopy conditions in sage brush habitats.

Conservation and protection measures: Retention of adequate mature sagebrush habitat at a watershed scale would provide for ensured habitat for populations of this species. Although to what level is unknown, it is assumed that within a range of what likely historically occurred is reasonable (Holmes and Johnson 2005), and this would also facilitate management towards ensuring sustainable and diverse conditions occur. Should sagebrush be managed towards all of a high canopy cover and density, the habitat is more at risk for large losses due to wildfire, and do not provide the needed diversity of the grass/forb stage for other species. Mosaics created by prescribed burning may be most beneficial, though this could also be accomplished through other mechanical methods or herbicide. The habitat management guidelines developed for sage grouse for late-summer brood rearing habitat (Connelley et al 2000) would likely be adequate for this species. It should also be noted that Brewer's sparrows have a strong nest area fidelity, with abandonment from treatments lasting a considerable time until sagebrush is of enough density to reestablish nesting use. Paige and Ritter (1999) recommend small scale, patchy prescribed burns for habitat diversity considerations, and should be conducted in the late spring or fall. This has been typically practiced, and the *vaseyana* subspecies of sagebrush common to most of the mountain revegetates well following prescribed burning.

Insecticide spraying for insects would presumably have an affect on this species, secondarily, as prey may be removed or secondary poisoning could result. This is not currently an established practice on the Forest.

Cowbird parasitism, as mentioned above, may accompany concentrations of livestock and have the potential to affect populations by replacing eggs from host nests (of neotropical migrants) with their own. Rotational livestock grazing and delaying grazing until later in the nesting season often provides sufficient mitigation for this potential impact.

As mentioned previously, activities that have potential to expand cheatgrass or noxious weeds should be closely monitored to ensure further loss of habitat does not occur. Prescribed burning in known cheatgrass or weed patches should not occur.

Roads can have negative effects on the species. In addition to habitat loss through additional road construction, traffic volume (dust and noise), and displacement by other species more adapted to roads and edge (horned larks) also have effects. Additional road construction should be minimized (Ingelfinger 2001).

Grazing and prescribed burning in sagebrush affect the amount and quality of habitat for the Brewer's sparrow. Grazing may remove some potential habitat for prey, but also typically furthers the advancement of mature canopy conditions in sagebrush. Prescribed burning may remove nesting habitat, but also helps maintain a diversity of age class structures in sagebrush habitats, mimicking natural disturbance processes that have been curtailed due to fire suppression efforts in many areas on the Forest.

Sage sparrow (*Amphispiza bellii*)

Status and distribution of species: Sage sparrows are well distributed within Great Basin and other sagebrush habitats in northwest North America, and are native to this portion of Wyoming (Martin and Carlson 1998). Sage sparrows are a migratory species, wintering in the southwest US and north-central Mexico, and are considered a sagebrush obligate (Cerovski et al 2001). Regionally, at the state level, the trend is stable, though data is somewhat inconclusive (Sauer et al 2001). This species is categorized as a G5S3 species through the natural heritage program ranking, is considered a Level I priority species (conservation action) by Wyoming Partners In Flight, and is a Forest Service sensitive species. These rankings indicate some degree of conservation concern.

Population status and distribution on the Bighorn NF: They are not known to currently occur on the Forest, as examined in the two routes of Breeding Bird Survey results (Sauer et al 2001), Merrill (1997), Downing (1990), WYNDD (2002), Wyoming Observation System database (WGFD 2002), Beels (1996), and RMBO (2005). Downing (1990) considers them to have potential to breed in areas represented by the Forest, however Paige and Ritter (1999) indicate a 6,500' elevation limit, though Martin and Carlson (1998) mention observations above 7,800'. Latitude and elevation may both limit the species' presence or potential for occurrence on the Forest, as they are known to occur in areas surrounding the Forest. The Forest would be at the northeast limit of its currently established range (Martin and Carlson 1998), which may further limit observation potential.

As it is an unknown occurrence on the Forest, it is impossible to determine if populations on the Forest are similar to historic levels or not. Significant acreages of sagebrush habitat have been lost throughout the West due to European settlement influences, such as conversion to agriculture, urban development, or losses due to cheatgrass invasion. These changes are likely having an effect on sage sparrow populations, though these effects currently are not occurring to a significant extent on the Forest as compared to lands surrounding it.

Habitat status on the Bighorn NF: Sage sparrows are dependent mostly on sagebrush habitats, tending towards the more mature stands in terms of age class, and larger stand sizes (Paige and Ritter 1999). Food sources are primarily insects in the summer, with seeds of grasses and shrubs a secondary source. Nests are typically constructed in the bottom portion of sagebrush plants, typically in the taller shrubs. Refer to the habitat description and status under the short-eared owl for this species.

Currently, it is estimated that there is not a lack of mature sagebrush habitat on the Forest, though the trend in the near future would be for additional treatment of these areas to achieve greater age class diversity. There appears to be adequate habitat to support viable populations of the species on the Forest, despite losses due to road construction. This will need to be tempered with knowledge of age class distributions at the project scale.

Threats, limiting factors, vulnerability to Forest Service management activities: The threats and limiting factors for this species would be similar to those described for the Brewer's sparrow above.

Conservation and protection measures: The Wyoming Bird Conservation Plan (Cerovski et al 2001), Birds in a Sagebrush Sea (Paige and Ritter 1999), Birds of North America (Martin and Carlson 1998), Holmes and Johnson (2005), and the Sage Grouse Management Guidelines (Connelly et al 2000) were reviewed to determine habitat needs. Conservation measures summarized include:

1) Prevent large-scale fires. Conduct prescribed burns that are small and patchy that maintain habitat diversity. Retain areas of large expanses of sagebrush habitat (minimize edge created). Prescribed burns should not occur in weed or cheatgrass infested areas.
2) Maintain native grasses and forbs through proper grazing limitations. Use rotational grazing systems to provide rest and areas with reduced potential for cowbird parasitism. Provide for retention of approximately 50% of current year's growth of herbaceous vegetation for nesting cover in the following season. Rest burned areas from grazing to provide adequate regeneration of native vegetation. Control non-native vegetation (weeds and cheatgrass) to prevent additional loss of sagebrush habitats.
3) Minimize insecticide use. Do not conduct aerial application of insecticides.
4) Limit number of new roads, reclaim old ones not being used. Discourage road construction and other developments where it would reduce sagebrush habitat patch size.
5) Retain sage habitat (no type conversions).
6) Provide escape ramps at livestock water facilities.
7) Maintain water abundance and associated vegetation at springs and seeps.
8) Provide a mosaic of open (5%) to moderate (25%) shrub canopy cover on the landscape, with some patches retained in a large mature condition greater than 200 acres to provide potential nesting habitat for this species.

Following management guidelines for sage grouse late summer brood rearing habitat would benefit this species when considering treatments for habitat diversity.

Grasshopper sparrow (*Ammodramus savannarum*)

Status and distribution of species: Grasshopper sparrows are distributed primarily in the eastern U.S., with limited occurrences in the northwest and the coast of California. The Big Horns are at the western edge of their main distribution. The species winters in Florida, Mexico, and Central and South America (Vickery 1996). Regionally, at the state level, the monitoring data from BBS trends is up 5%. Notable data limitations occur with breeding bird survey results. This species is categorized as a G5S4 species through the natural heritage program rankings, is a Forest Service sensitive species, and a Wyoming Partners In Flight Level II (monitoring) species.

Population status and distribution on the Bighorn NF: They are known to occur on the Forest primarily in grasslands and riparian areas (Beels 1996; Merrill 1997), presumably forest-wide. Breeding Bird Survey trends (Sauer et al 2001) indicate a downward trend on the Bald Mt. Route, and an upward trend on the Crazy Woman route, though with noted data deficiencies. Point count monitoring for the sagebrush/grassland and montane riparian habitats have not provided any observations of this species (RMBO 2005).

It is difficult to determine if populations are similar to historic levels or not on the Forest. There are currently no known population estimates or trends for the species on the Forest, which can exhibit fluctuations depending on insect availability and other climate related functions. There has been little habitat lost on the Forest. Declines in habitat have been noted elsewhere in its range through urban development and agricultural conversion. Irruptions and movements in populations can occur in response to prey levels. Birds may also exhibit seasonal elevational migrations. They are readily able to disperse as they are an avian species.

Habitat status on the Bighorn NF: Grasshopper sparrows generally prefer moderately open grasslands and prairies with patchy bare ground, with noted occurrences in riparian areas in the West (Vickery 1996; Hutto and Young 1999). They prey primarily on insects, and consume seeds in the winter. It nests on the ground at the base of clumps of grass, with a side entrance. Breeding territory sizes are typically 1-3 ha (2.5-7.5 ac), but vary according to habitat and prey abundance.

Habitat conditions for this species would be largely similar to those described for the northern harrier previously.

Threats, limiting factors, vulnerability to Forest Service management activities: Grazing can be of concern in shortgrass prairie systems if nesting cover is removed extensively (Vickery 1996). Rotational grazing practices and utilization standards of forage by livestock should allow for adequate habitat for the species. Widespread fire impacts to shortgrass prairie may also be detrimental. Brood parasitism from cowbirds occurs, though typically at a lower rate.

Over-grazing may reduce conditions supporting adequate levels of prey, and associated nesting habitat. Maintaining areas with dense and tall vegetative cover on the landscape is desirable for grassland areas, though it is unknown what percent of a given landscape should be maintained in this fashion. Trampling of nests and or disturbance during the

breeding season is considered a possibility, though perhaps somewhat rare. The most likely range-wide impacts to the species are from habitat loss, fragmentation, and degradation (Slater 2004; Vickery 1996).

Wildfires and/or prescribed burning may temporarily reduce (one or more seasons) potential nesting habitat, however both are or mimic natural processes responsible for rejuvenation of grassland habitats. In general, burning occurs somewhat irregularly in these habitat types on the Forest, sometimes due to a lack of fuel from grazing. When sagebrush sites are burned, more habitat could be temporarily created for this species. Similarly, burning or removing conifer encroachment into meadows where this occurs on the Forest would also prolong the provision of meadow habitat for this species. Prescribed burning should be avoided for main nesting seasons, including May – July, where feasible. It is also noted that prescribed burning typically impacts few acres of this habitat type in any given year, regardless of season of burn. It is important to note that low to moderate levels of grazing and prescribed burning have been shown to be beneficial or at least of negligible effect to this species (Slater 2004; Vickery 1996).

It is not thought that either disease or predation is occurring above normal levels for the species that could further exacerbate any known conditions. Since the species is a ground-nester, predation is often a higher cause of mortality. Variances in prey abundance would are known to cause variances in population levels for this species in any given year. The species exhibits relatively low fidelity to nest sites, indicating an ability to move following disturbances (Vickery 1996).

Conservation and protection measures: The Wyoming Bird Conservation Plan (Cerovski et al 2001) and Slater (2004) was reviewed to determine habitat needs for this species. Summarized conservation measures include the following that were considered in development of the Revised Plan:

1) Delay grazing in shortgrass habitat until after the end of the nesting season where feasible to ensure that grass cover is available for nesting. Rotational grazing practices and disturbances should help provide habitat for this species.
2) Avoid burning large areas of shortgrass prairie habitats. Where feasible, conduct prescribed burns in the fall rather than spring. Singing perches and taller vegetation may require several years to establish following disturbance.
3) Minimize application of insecticides in controlling forest insects.

Greater sage grouse (Centrocercus urophasianus)

Status and distribution of species: The sage grouse occurs locally in arid areas from southern Canada south to southern Utah and from central California east to western South and North Dakota. The species has been extirpated in Kansas, Nebraska, Oklahoma, Arizona, New Mexico, and British Columbia. Rangewide declines in habitat from development, cultivation, burning, overgrazing, and habitat conversion (e.g. cheatgrass) have resulted in overall population declines for the species in its range (Schroeder et al 1999).

Sage grouse in Wyoming are more stable than populations in other western states, with a heritage program ranking of G4S4. Due to recent concern over habitat and populations west-wide, the Rocky Mountain Region of the Forest Service has listed this species as sensitive. There is potential for this species to be federally listed (T or E) due to recent petitions for listing (USFWS 2002). Sage grouse may have been more prevalent on the Forest and adjacent to it prior to European settlement based on known hunting and exploitative trends that occurred with settlement (Blair, 1987; King, 1992), though primarily due to the aforementioned habitat declines.

Population status and distribution on the Bighorn NF: Sage grouse are native to the Forest, however no known leks (breeding grounds) occur on the Forest. All closest known leks to the Forest occur along the western flank of the Bighorns, and grouse move up onto the western side of the Forest in later summer from these areas, through relatively short migrations (WYOBS 2002). There are no known leks within 2 miles, nor summer habitat use onto the Forest on the east side of the range. Two records of grouse near the Clear Creek area close to Buffalo may be misidentified grouse species. On the western side of the Forest, grouse leave the Forest to winter on lands adjacent to it. Sage grouse are readily able to disperse, depending on the availability of habitat, as they are an avian species. Populations are usually described as being either migratory or non-migratory depending on the distance of typical migrations from winter to summer habitat (Connelly et al 2000), placing grouse on the Forest in a largely non-migratory category. A survey flight was conducted in April of 2005 to search for leks closer to or on the Forest in the southwest corner of the Forest, however none were found.

Sage grouse populations on the Forest are largely dependent on the conditions surrounding their primary habitat off the Forest (breeding and brood rearing habitat). Some of these areas have had negative effects from past land use practices. Although declines were noted to have occurred in many areas of the west from disease and other factors in the 1930's and 1940's, the current lek counts for populations surrounding and using the Forest are down with respect to historical lek counts that have occurred since the 1960's (T.Easterly pers. comm. 2002).

Habitat status on the Bighorn NF: The species is strongly associated with sagebrush habitat types, though riparian areas are also particularly important with respect to brood rearing and summer habitat use (Connelly et al 2000). Breeding display grounds ("leks") are open areas surrounded by sagebrush.

Nests are usually placed on the ground beneath big sagebrush. After the eggs hatch, the brood leaves the nest area. Preferred habitat for young includes moist areas with forbs and insects. Sage Grouse feed on sagebrush leaves in the winter. In summer, they also eat forb leaves and flowers, and insects (especially grasshoppers during irruptions). Refer to the species assessment in the project record for a map of current distributions and likely potential habitat. Status of sagebrush habitat as described under the short-eared owl would also apply for the sage grouse.

The habitat on the Forest is best described as late summer brood-rearing according to the management guidelines (Connelly et al 2000). A mix of ranges in age class structure and

landscape mosaics are necessary to support grouse, due to foraging preferences in younger age classes and escape or roosting cover in older age classes. The sagebrush (*Artemesia tridentata*) habitat on the west side of the Forest occurs at a predominately moister regime, and is primarily of the *vaseyana* type, which responds better to prescribed burning and other treatments due to the higher moisture available at the sites as compared to lower elevation sites. Habitat on the Forest is currently estimated as stable, though somewhat vulnerable to widespread fires, should they occur, as there is in general widespread occurrence of older age classes.

The distribution of sagebrush habitat has not likely changed on the Forest over time, as this is a soil related function (Despain 1973), with fires determining the age class distribution of sagebrush. Livestock grazing has historically altered sagebrush habitat in most mountain ranges in the west, causing an increase in shrub canopy cover with less diversity of forbs and grasses in the understory (Connelly et al 2000). However, sagebrush treatment projects were also carried out on the Forest to reduce sagebrush canopies and increase forage available for livestock, which would have counteracted this effect in localized areas, particularly in and around Shell Canyon. Sagebrush habitat on the Forest has not undergone conversion to cheatgrass or large patches of noxious weeds, as has been a common problem in other areas of the species' range. This is likely due to the elevation of the Forest. Sagebrush habitat in many areas of the Forest may be represented by more mature stand conditions than what likely occurred historically, as active fire suppression over the past several decades has caused many of these habitats to miss a disturbance cycle or two. Currently, the condition of sagebrush habitats on the Forest is not known to be a limiting factor for the populations that use the Forest. The condition of winter, breeding, and early brood-rearing habitats (off-Forest) may be more of a limiting factor for grouse populations than summer habitat conditions.

The Forest has not recently participated in any poisoning of potential prey as occurs in some areas through grasshopper control, so this is not thought to be of effect. The last project of this type conducted on the Forest was in 1992, but more likely occurred in the 1970s and 1980s, with all of it being aerial application of pesticides.

There have been no specific studies of sage grouse or sage grouse habitat on the Forest. The Forest began coordinating with the BLM and Wyoming Game and Fish in 2002 to establish treatment records of where sagebrush habitat has been and would be proposed for treatment in the near future, taking into consideration the need for a variety of age classes of sagebrush on the landscape.

Threats, limiting factors, vulnerability to Forest Service management activities: Loss of sagebrush mosaic, fragmentation of large tracts of sagebrush, alteration of the grass/forb understory, and disturbance at leks have been the major threats to sage grouse (Connelly et al 2000). The declining range, reduced population, and increasing isolation of breeding populations make the species vulnerable to further local losses.

There are many areas on the Forest that have missed natural fire events due to suppression. However, the Forest and BLM adjacent to it have also been more engaged in prescribed burning activities to correct this trend. This tool could be over-used and create too many

areas with a lack of mature cover, which prompted the development of the management guidelines referred to below. Noxious weeds also have the potential to affect habitat, though this has been in very localized areas to date. Livestock grazing may reduce the availability of forbs and grasses important for broods, however grazing at proper levels is a sustainable use given sage grouse habitat needs in late summer brood rearing areas. Riparian area habitat in healthy condition is also important for the species during this time period, with free-flowing springs.

Fall hunting takes place, though primarily off of the Forest as birds have begun to move back down to winter range by that time. Predation occurs from native predators, and is not thought to be at a level of concern for the species currently. Populations and brood sizes are largely dependent on climate related factors and insect levels. Responses to favorable conditions are not easily shown in population dynamics due to the delay from one year to the next, and with broods limited at approximately 6 eggs, and low nesting success in some areas. There are not currently any disease elements that appear to be outside of normal ranges of this type of mortality. Disturbances from public viewing on leks has become somewhat of a problem in other states, though it is not likely a large concern on lands surrounding the Bighorns. Similarly, human uses at nesting sites could also disrupt nesting attempts, which also would not likely occur on the Forest.

Impacts from insecticide application may also reduce potential prey sources, as stated above. Collisions with vehicles, fences, and powerlines are also possible sources of mortality (Schroeder et al 1999).

Conservation and protection measures: The following guidelines (Connelly et al 2000) pertain to all seasonal habitats used by sage grouse, and were considered in the development of forest-wide direction for the Revised Plan. General goals and objectives should include the effort to eliminate any noxious weeds, and to treat adequate amounts of sagebrush to maintain a diversity of age class structures at the landscape scale.

1. Monitor habitat conditions and only propose treatments if warranted by range condition (i.e., the area no longer supports habitat conditions described in the following guidelines under habitat protection). Do not base land treatments on schedules, targets, or quotas.
2. Use appropriate vegetation treatment techniques (e.g., mechanical methods, fire) to remove junipers and other conifers that have invaded sage grouse habitat. Whenever possible, employ vegetation control techniques that are least disruptive to the stand of sagebrush, if this stand meets the needs of sage grouse.
3. Increase the visibility of fences and other structures occurring within 1 km of seasonal ranges by flagging or similar means if these structures appear hazardous to flying grouse (e.g., birds have been observed hitting or narrowly missing these structures or grouse remains have been found next to these structures).
4. Avoid building powerlines and other tall structures providing perch sites for raptors within 3 km of seasonal habitats. If these structures must be built, or presently exist, the lines should be buried or poles modified to prevent their use as raptor perch sites.

Summer/Late Brood-rearing Habitat Management

Sage grouse may use a variety of habitats including meadows, farmland, dry lakebeds, sagebrush, and riparian zones from late June to early November. Generally, these habitats are characterized by relatively moist conditions and many succulent forbs in or adjacent to sagebrush cover. Brood-rearing habitat should be managed generally to provide sagebrush with 10-25% canopy cover, with 15% of the canopy in grass and forbs. This should be provided on the landscape scale, with > 40% of the area meeting this description.

Habitat protection

1. Avoid land use practices that reduce soil moisture effectiveness, increase erosion, cause invasion of exotic plants, and reduce abundance and diversity of forbs.
2. Avoid removing sagebrush within 300 m of sage grouse foraging areas along riparian zones, meadows, lakebeds, and farmland, unless such removal is necessary to achieve habitat management objectives (e.g., meadow restoration).
3. Discourage use of highly toxic organophosphorus and carbamate insecticides in sage grouse brood-rearing habitats. Sage grouse using agricultural areas may be adversely affected by pesticide applications (Blus et al. 1989). Less toxic agri-chemicals or biological control may provide suitable alternatives in these areas.
4. Avoid developing springs for livestock water, but if water from a spring will be used in a pipeline or trough, design the project to maintain free water and wet meadows at the spring. Capturing water from springs using pipelines and troughs may adversely affect wet meadows used by grouse for foraging.

Habitat restoration

1. Use brush beating or other mechanical treatments in strips 4-8 m wide in areas with relatively high shrub canopy cover (≥35% total shrub cover) to improve late brood-rearing habitats. Brush beating can be used to effectively create different age classes of sagebrush in large areas with little age diversity. *Due to the steeper slopes and cost, and success with regeneration following burning, this technique has not been used on the Bighorn*.
2. If brush beating is impractical, use fire or herbicides to create a mosaic of openings in mountain big sagebrush and mixed shrub communities used as late brood-rearing habitats where total shrub cover is ≥35%. Generally, 10-20% canopy cover of sagebrush and ≤25% total shrub cover will provide adequate habitat for sage grouse during summer, if provided over 40% of the landscape area.
3. Only construct water developments for sage grouse in or adjacent to known summer use areas and provide escape ramps suitable for all avian species and other small animals. *Water developments have not been constructed solely for sage grouse on the Bighorn due to the adequate distribution of water*.
4. Whenever possible, modify developed springs and other water sources to restore natural free-flowing water and wet meadow habitats.

It is assumed that management of livestock grazing allotments would continue and address potential overgrazing issues.

Cary beardtongue *(Penstemon caryi)*

Status and distribution of species: *Penstemon caryi* is a regional endemic to northcentral Wyoming and southern Montana in the Big Horn and Pryor Mountains (Fertig 2000). It is known from 22 extant and 1 potentially extirpated location in Wyoming (USDA Forest Service 2003). It is a G3S3 species in Wyoming, indicating its moderate rarity. The total population in Wyoming is approximately 19,000-22,000 plants, but clumps of plants are usually widely scattered and limited to small patches of suitable land. Though long-term trend data are unavailable for most Wyoming populations, short-term trends of three populations have shown that they are stable to increasing (Fertig 2002).

Population status and distribution on the Bighorn NF: There are 13 known locations on the Forest (Scholl and Smith 2001; Heidel and Handley, 2004). The populations are concentrated on the northern end of the Forest, and most occur on the west slope. The Shell Creek population from 1932 may have been extirpated by road construction. Andrew Lutz was unable to relocate it in 2000, and he suspects that it was destroyed by road construction (Fertig 2002). Bornong (personal communication) also attempted, but failed to relocate the population in 1999. In general, the populations are considered to be relatively secure and stable.

Habitat status on the Bighorn NF: In Wyoming, *Penstemon caryi* inhabits sparsely vegetated rocky outcrops of calcareous bedrock or on barren, actively eroding limey clay slopes from 5,200-9,600 feet elevation in big sagebrush, Rocky mountain juniper, or Ponderosa pine meadows. *P. caryi* is an early seral species, not tolerant of competition, that prefers vegetative cover of less than 20% (USDA Forest Service 2003). Unsurveyed potential habitat exists on the Bighorn NF, especially on the northern end and on the west slope. There are currently minimal impacts to these types of habitats on the Forest.

Threats, limiting factors, vulnerability to Forest Service management activities: *Penstemon caryi* inhabits south facing slopes of 0-80% with very low forage potential, and little associated vegetative cover. However, on the flatter locales it has been noted that *P. caryi* is frequently grazed by a variety of herbivores, especially rodents (Fertig 2002). Observations of Bighorn NF populations have not revealed livestock herbivory even when cattle are present and the population is accessible (Bornong, personal communication).

Collection by enthusiasts has been mentioned as a potential problem, but many sites are too rocky and steep for frequent collection by passersby. Loss of habitat from road construction, limestone quarrying and exotic plant introduction may disrupt *Penstemon caryi* populations, but also may expose suitable soil for new populations (Heidel and Handley 2004; Fertig 2002). Overall, threats to *Penstemon caryi* are minimal. Prescribed burning would likely have minimal impact due to the difficult nature of getting fire to carry through these sparse sites. Invasion of existing and potential habitat from noxious weeds may be of concern for this species.

Penstemon caryi is a regional endemic with relatively low abundance in scattered microsites; however, threats to its habitat are minimal. *Penstemon caryi* "is more widespread and less imminently threatened by human activities than once suspected and

probably does not warrant significant management attention under present conditions" (Fertig 2002).

Conservation and protection measures: Where known populations have the potential to be impacted by management activities, such as road or trail construction, activities may be spatially buffered from plant populations. No other activities are currently known to be of significant threat.

The current priorities for the Forest are monitoring and maintaining the viability of known populations. Finding new populations and getting population estimates from the Dry Fork Ridge and Fisher Mountain populations on the Bighorn NF are also potential priorities for the future. An aggressive noxious weed management program would also benefit potential habitat for this species (Heidel and Handley 2004).

Hall's Fescue (*Festuca hallii*)

Status and distribution of species: Hall's fescue is a tufted perennial grass up to 20-80 cm tall. Flowering and fruiting occur from May through July. Additional information on the species, including life history stages, population structure, longevity, mortality, and seed biology, are not available.

Festuca hallii exists from Alberta to Ontario, and in Montana, Washington, North Dakota, Colorado and Wyoming (NatureServe 2003). It is a G4S2 species in Wyoming, indicating its rarity. There are 10 confirmed records and 1 vague historical record (1898) from Wyoming. In Wyoming, Hall's fescue occurs is known from the Shoshone and Medicine Bow National Forests. It is also known from lands managed by the state and BLM. In Colorado, it is known to occur on the Arapaho-Roosevelt National Forest. It does not seem to be common anywhere in its range. In Wyoming, surveyed populations contain 500-1000 plants, but most populations have never been evaluated (Fertig 2002). Existing populations are considered to be relatively secure, though trends are relatively unknown.

Population status and distribution on the Bighorn NF: A historical record by Williams and Griffiths from 1898 reports a population near a "branch of Crazy Woman Creek." The specimen was originally named *Festuca confinis* var. *rabiosa* by Piper in 1906. This taxon became *Festuca kingii* var. *rabiosa* by Hitchcock in 1934, and then changed to *Hesperochloa kingii* var. *rabiosa* by Swallen in 1941. Agnes Chase synonymized the earlier names under *Festuca scabrella* in 1950. *Festuca scabrella* is a taxonomically complex species that has been subdivided into three taxa, including *Festuca hallii*. Walter Fertig attempted and failed to relocate the historical population in 2000. Fire, intense grazing, or competition by exotic weeds may have extirpated the population (Fertig 2002).

Habitat status on the Bighorn NF: *Festuca hallii* exists on high montane and subalpine grasslands on calcareous substrates and at the edge of coniferous forests of lodgepole pine and Engelmann spruce from 6,800-11,000 feet. Potential areas that have not been surveyed are the Canyon Park area south of the Powder River Pass, Penrose Park and Dry

Fork Ridge (Fertig 2000). Known associates are *Potentilla fruticosa, Artemisia tridentata, Danthonia intermedia, Lupinus wyethii, Geum triflorum, Zigadenus elegans,* and *Penstemon spp*. The habitat is naturally fragmented across the Forest landscape.

Walter Fertig produced two models of potential habitat for the Bighorn National Forest using environmental variables (mean monthly precipitation, mean monthly temperature, elevation, GAP land cover, bedrock geology, and soils) based on 14 known locations of *Festuca hallii* in Wyoming and Colorado. Of the two, the "range model" was used to produce a useable model for survey. 70 polygons of suitable habitat were identified in the Bighorn Mountains. 18 were in completely forested areas, and 6 were off of the Forest. Fertig conducted field surveys, during 22-25 June and 28-31 July 2001, of 22 polygons represented by the range model, and 8 additional polygons represented by the second model. Some of the sites appeared promising, but were inhabited by other bunchgrass species such as *Leucopoa kingii, Festuca idahoensis, Poa secunda*, and *P. junciformis* (Fertig 2002). Given the vague initial report, the taxonomic difficulties, and the recent surveys that failed to find *F. hallii*, this species may not exist on the Bighorn NF.

Current conditions of potential habitat (grasslands) would be similar to those described above for the northern harrier.

Threats, limiting factors, vulnerability to Forest Service management activities: *Festuca hallii* may be vulnerable to heavy grazing as it is a highly palatable species that may decrease under pressure (Fertig 2002). Grazing and stock trampling could affect individuals and reproductive status.

Other threats could include loss of plants or habitat through development or road and trail construction. Noxious weed invasion could also be of potential risk to this species' native habitat, from vectors including both livestock and wildlife, recreation use, and travel management (roads, trails).

Prescribed burning may present some risks for this species, though its historic presence in fire adapted ecosystems would suggest that this species survives fire.

Conservation and protection measures: Grazing allotment management plans can be modified to contain considerations for this species and exclosures constructed, if needed to maintain viable populations, should there be any found on the Forest.

Continuation of an aggressive program to eradicate and manage noxious weeds would serve to protect potential habitat for this species.

Should locations be found on the Forest, there would also need to be protection from any ground disturbing activities or from changes in soil moisture in the area of its existing and potential habitat in the immediate vicinity.

Tranquil goldenweed (*Pyrrocoma clementis var. villosa*)

Status and distribution of species: This species has a G3G4S1 heritage ranking for Wyoming. *P. clementis* var. *villosa* is known from 2 extant occurrences and 4 historical records (USDA Forest Service 2003).

Population status and distribution on the Bighorn NF: *Pyrrocoma clementis* var. *villosa* is endemic to the Big Horn Mountains of Wyoming. (NatureServe 2003). There are 3 known locations on or near the Forest, all of which are historical from observations between 1900 and 1960 (Scholl and Smith 2001). The species was found adjacent to the Forest near the Cold Springs road in 2004 by revisiting historical observation points.

Habitat status on the Bighorn NF: *P. clementis* var. *villosa* is normally found between 7,600-12,600 feet elevation in sagebrush grasslands and montane meadows on limestone substrates (USDA Forest Service 2003). It has potential habitat on the lower Forest foothills and mesas on limestone soil.

The status of the potential habitat for this species would be similar to those mentioned for Hall's fescue.

Threats, limiting factors, vulnerability to Forest Service management activities: The threats for this species would be similar to those listed for Hall's fescue.

Conservation and protection measures: The conservation measures for this species would be similar to those listed for Hall's fescue.

Direct, Indirect, and Cumulative Effects on Grassland, Sagebrush, Shrub Steppe Habitats and Associated Species

Direct effects from management activities are tied primarily to recreation management (e.g. dispersed camping, etc.), livestock grazing and prescribed burning, and any habitat loss from road or trail construction. With current practices of surveying for sensitive plant and animal species in association with most site specific projects, direct effects are typically minimized by protecting species and their habitat through temporal and/or spatial buffers. However, there is always a chance that surveys may miss finding a plant or animal occurrence, with possible adverse impacts. Monitoring of known populations or occurrences also helps determine what level of effects that management activities are having. Nesting habitat for birds and potential habitat for animals and plants can be directly removed or altered through management activities.

Effects from timber harvest on this resource would be minimal, as only road construction or skidding would likely impact habitat. Road construction needs or anticipated levels would be greatest in Alternatives E and A, ranging downward to both Alternative D's, B, and C respectively. Prescribed burning, a temporary change of habitat condition, would likely be greatest under Alternative B, followed by both D's, C, A and E. Overall, prescribed burning would fall short of putting the sagebrush/grassland cover types into a

"regulated treatment" regime where these sites are routinely burned over time to ensure an even distribution of age classes and diversity. Wildfire would likely make up the difference in some cases or locales. Recreation use, causing the loss of some vegetated areas and possibly disturbing some sensitive species, is expected to increase under all alternatives. Highest levels of motorized recreation use may occur in Alternatives E and A due to increased road networks. Livestock grazing would occur similarly over all alternatives, with updated/revised standards and guidelines for forage utilization.

Indirect effects may occur to potential prey, such as insects or small mammals, or loss of pollinators for some plants. Indirect effects also include the increase of noxious weeds that could occur as a result of livestock grazing, prescribed burning, road construction and recreation use. Noxious weeds could remove or replace habitat necessary for the sensitive species. Snowmobiles could indirectly effect snow melt/runoff for some of the species in this habitat type, though this impact is anticipated to occur on less than 50% of the meadows/sagebrush areas on the Forest.

Indirect effects to wildlife species can occur from human disturbance. This has the potential to occur from all activities, including harvest, recreation, livestock grazing, etc. Where increased road densities may occur, particularly in Alternatives A and E, there could be more potential for human disturbance. Alternative D-DEIS and D-FEIS would have a more moderate increase in road density, and Alternatives B and C would have minimal to nonexistent increases in road density.

In general, the **cumulative effects** analysis area considered for this resource includes the Forest and one mile adjacent to its boundary. From this point on, the lower elevation influences dominant grass and sagebrush subspecies resulting in a different habitat composition for the most part. Significant impacts to sagebrush and grassland cover types have occurred off of the Forest due to agricultural and non-native species (e.g. cheatgrass) expansions. Past, present, and reasonably foreseeable cumulative effects that were considered are described in the FEIS in the introduction to Chapter 3 in a table. Cumulative effects of each alternative with these other known and foreseeable activities were summarized through the cumulative effects viability determinations made for each species. The viability determinations are summarized in the biodiversity section of Chapter 3 in the FEIS in the single species analysis portion. The Viability Analysis document in the project record provides further supporting rationale for each determination made.

Cumulative effects above and beyond the direct and indirect effects described above are minimal on the Forest due to the limited amount of private land within the Forest boundary. There are no known proposals for additional development of any of these lands. State land within the Forest boundary may have additional highway widening, particularly along the Cutler Hill stretch of Highway 14, though impacts to grass/sage are likely to be small (less than 100 acres "lost") due to the current location of this road on sideslopes and ridgetops. Lands adjacent to the Forest are primarily private and/or BLM. Private lands would continue to receive pressure from urban development trends. These activities should not impact habitat on the Forest, but may increase the value of sage/grass habitat on the

Forest. Overall, road densities are anticipated to increase on lands adjacent to the Forest.

The most significant cumulative impact to sage/grass habitat and species on the Forest would continue to be from natural disturbance processes, prescribed burning, livestock grazing, and non-native plants. Variations in the amount of sage/grass are anticipated to fluctuate naturally on the Forest and adjacent to it due to natural disturbances.

With regards to the alternatives considered in the FEIS, those alternatives that would seek to create additional disturbances associated with roads, and the potential for "lost" habitat would have the most potential for increasing cumulative effects. Non-native species impacts would also potentially increase with additional roading. The following table summarizes how the anticipated effects of implementing the alternatives would cumulatively impact habitat in species, considered in conjunction with the past, present, and reasonably foreseeable actions as mentioned above.

Table K-8. Relative cumulative impact of alternatives on the sage/grass associated sensitive species.

Land Use Category	**Less Impact← Relative Impact →More Impact to sage/grass associated species**					
Effects from land authorizations	No difference between alternatives					
Effects from motorized recreation mgmt. (potential for user created roads)	C	B	D-DEIS	D-FEIS	A	E
Effects from livestock grazing	No difference between alternatives					
Effects from timber harvesting (tied to road effects)	C	B	D-DEIS	D-FEIS	A	E
Lands allocated to Management Area category 5 (most active management)	C	B	D-DEIS	D-FEIS	A	E
Effects from prescribed fire	E	A	C	D-DEIS	D-FEIS	B
Effects from wildland fire	E	D-DEIS	D-FEIS	A	B	C
Effects from utility corridors	No difference between alternatives					
Land available for locatable minerals and oil and gas	C	B	D-DEIS	D-FEIS	A	E

The effects above show estimated future disturbance differences between alternatives. Individual species protections would be ensured through preparation of site specific NEPA analysis and Biological Evaluations, with protection offered through forestwide standards and guidelines as described above. Overall, road densities are anticipated to increase on lands adjacent to the Forest. These impacts place a higher value on the Forest in terms of intact habitat. The BLM and Forest Service have begun coordinating prescribed burn efforts in recent years to address the potential for treating too many acres with regard to the need for diversity in age class structure.

Determinations and Rationale

Based on the above analysis, a determination of ***"may adversely impact individuals but not likely to result in a loss of viability over the planning area nor cause a trend toward listing or a loss of species viability rangewide"*** is made for all of the species analyzed in this section for all alternatives. There was not a significant enough difference in alternatives to warrant a different determination, though there is likely some increased risk with alternatives that increase road densities, such as Alternatives E and A, and to a lesser extent both D's. A "no impact" determination was not warranted due to the uncertainty of some harvest activities and recreation uses and potential disturbances to species, or unknown species' distributions. This determination applies to the following species:

Northern harrier	Sage sparrow
Short-eared owl	Grasshopper sparrow
Loggerhead shrike	Greater sage grouse
Brewer's sparrow	Cary beardtongue
Hall's fescue	Tranquil goldenweed

Summary of conservation measures for sensitive plant species

The Bighorn National Forest has been actively managing for sensitive and rare plant species for at least the past two decades. Work since the 1985 Plan implementation has focused on:

a. Inventory – determining which species are indeed rare on the Bighorn NF. Surveys have shown that species once considered rare were actually quite plentiful, such as *Agoseris lackeschwetzii* and *Aster mollis*, while other species (*Rubus acaulis*) were found to indeed be rare.

b. Monitoring – once species are determined to be rare, it is important to learn about their habitat and environmental influences on the Bighorn NF. Two types of monitoring are being conducted on the Forest:

   i. Population trend monitoring – Annual permanent transect monitoring to determine long term population trend

   ii. Disturbance monitoring – Tracking population and individual plant responses to various management activities, such as burning.

The following table summarizes the primary strategy(s) to be used for sensitive plants during this planning cycle. Further information is contained within the Rare Plant Management Strategy as described in the project record.

Table K-9. Sensitive plant conservation strategies for the Bighorn National Forest.

Species	Inventory[1]	Monitor	Remarks
Leathery grapefern	X		
Mountain lady's slipper		X	
Yellow lady's slipper	X	X	
Russet cotton-grass	X		
Grass-of-parnassus	X		
Cary beardtongue		X	
White larchleaf beard-tongue	X		Plant recently (7/2005) found on Bighorn NF
Wooly twinpod	X		
Tranquil golden-weed	X		
Northern blackberry		X	
Lesser bladderpod	X		
Hall's Fescue			Unlikely this plant still exists on Bighorn NF, if it ever did.

[1] Absence of a check in the inventory column does not mean that inventory will not be conducted; it indicates that substantial inventories have been conducted in the past, and it is a higher priority to spend resources monitoring populations and disturbance effects.

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