

APPENDIX B

**DARROCH-EAGLE CREEK TIMBER SALE
BIOLOGICAL EVALUATION
(Sensitive Species)**

Prepared by:

**Dan Tyers, Wildlife Biologist
Scot Shuler, Fisheries Biologist
Gallatin National Forest**

December 2, 2003

OUTLINE

INTRODUCTION

DESCRIPTION OF THE PROJECT

ANALYSIS AREA

SPECIES LIST

Plants

Fish and Wildlife

ANALYSIS OF IMPACTS TO PLANT SPECIES

Sensitive Plants – Species Potentially Present

Sensitive Plants – Surveys

Sensitive Plants – Survey Results

Sensitive Plants – Population Status of Identified Species

Sensitive Plants – Mitigation Measures

ANALYSIS OF IMPACTS TO WILDLIFE SPECIES

Sensitive Fish and Wildlife – Habitat Requirements of Species Potentially Present

Sensitive Fish and Wildlife – Surveys and Survey Results

Sensitive Fish and Wildlife - Population Status and Viability of Identified Species

Sensitive Fish and Wildlife - Conclusion of Effects

Sensitive Fish and Wildlife – Mitigation Measures

REFERENCES

INTRODUCTION

Sensitive species are plant and animal species identified by the Regional Forester in accordance with the National Forest Management Act for which population viability is a concern. Evidence supporting this scrutiny is based on two factors:

1. A significant current or predicted downward trends in population numbers or density.
2. A significant current or predicted downward trends in habitat capability that would reduce a species existing distribution.

A population is considered viable when it has the estimated numbers and distribution of reproductive individuals necessary to ensure the continued survival of the species throughout its existing range within the planning area (USDA 1995, p. 4).

A Biological Evaluation is a documented Forest Service review of programs or activities in sufficient detail to determine how a proposed action may affect each listed sensitive species. It is prepared for a range of alternatives as part of the effects analysis in the National Environmental Policy Act (NEPA) process (USDA 1995, p. 6-7).

DESCRIPTION OF THE PROJECT

This analysis considers the proposed Darroch-Eagle Creek Timber Sale. Five alternatives were developed to address key decision factors and issues. These alternatives are described in detail in Chapter 2 of the Environmental Assessment, Alternative Descriptions. The proposed Harvest Units are located in the upper Bear Creek and Eagle Creek drainages on the Gardiner Ranger District, approximately 4-8 miles northeast of Gardiner, Montana. The Units are between 7,400 and 8,600 feet in elevation on slopes that range from 15 to 50 percent slope. The legal description is T8S, R9E, Sections 25-27, 31, 32, 34, and 35. If the project is approved, the sale would be awarded in 2004.

Project objectives include:

1. To facilitate acquisition of private in-holdings (4 sections) within the Gallatin National Forest (GNF) owned by Big Sky Lumber Company (BSL) by using timber sale revenues to pay back money borrowed to finance the land transactions.
2. To contribute to the supply of wood products from the National Forest.

The Gallatin Land Consolidation Act, 1998, directed the Forest Service to acquire 4 sections of BSL land in the Taylor Fork area. This was to be accomplished by purchase with Land and Water Conservation Funds and 4.5 million dollars in timber receipts and other available funds from several National Forests over a 5-year period. Two of the 4 sections have already been obtained. Recent legislation enables the Forest Service to acquire the 2 remaining sections. If implemented, the Darroch-Eagle Creek Timber Sale would provide revenues towards the purchase amount.

ANALYSIS AREA

The analysis area is part of the Gardiner Basin, which straddles the Yellowstone River. Bear Creek is a tributary of the Yellowstone and one of the dominant drainages in the Basin. Eagle Creek is adjacent to Bear Creek and is a much smaller watershed. The analysis area is defined as the Bear Creek and Eagle Creek drainages, with the hydrologic divide forming most of the boundary and the Yellowstone River the remainder. Both are high-gradient mountain streams oriented roughly north to south. The confluence of Darroch Creek and Bear Creek is about midpoint in the drainage. Specifically, the analysis area incorporates Timber Compartments 305 and 306. Models used for species-specific effects analyses were based on these boundaries.

The analysis area contains an historic mining district centered around the small town of Jardine. After several decades of inactivity, Mineral Hill Mine was operative again from 1988-1997. No livestock allotments are present. Private land is primarily restricted to the communities of Jardine and Gardiner. The upper end of the Bear Creek drainage is included in the Absaroka Beartooth Wilderness and the lower portion is part of the Northern Yellowstone Winter Range, where large numbers of ungulates annually spend the winter. Logging activity began in the late 1800s and was associated with mining activity and homesteading. Commercial sales administered by the Forest Service began in the 1970s. A dendritic pattern of roads provided access for timber harvest and has been retained for recreational use and firewood cutting.

Vegetation is typical of mountainous areas at this latitude in the intermountain west. At the lower (southern) end are sagebrush/grasslands. Douglas-fir occupy the drier forest areas and lodgepole pine is dominant at mid-slope. Spruce is common in wetter areas. Substantial forests of whitebark pine are the highest elevation timber. Peaks on the divide extend above treeline.

Wildlife is plentiful and diverse. Bighorn sheep, mountain goats, elk, mule deer, whitetail deer, moose, mountain lions, grizzly bears, black bears, and wolves can all be found there. For a more expansive description of the analysis area and the associated wildlife populations, refer to the Biological Assessment.

SPECIES LIST

The 2003 GNF sensitive species list includes 21 plant species from the Region One list and 13 fish and wildlife species (USDA 2003). This list is periodically revised based on new information from field inventories.

Plants

Musk-root - *Adoxa moschatellina*
 Pink agoseris - *Agoseris lackschewitzii*
 Short-styled columbine - *Aquilegia brevistyla*
 Large-leaved balsamroot - *Balsamorhiza macrophylla*
 Pale sedge - *Carex livida*
 Slender paintbrush - *Castilleja gracillima*
 White paintbrush - *Castilleja longispica*
 Small yellow lady's-slipper - *Cypripedium calceolus* var. *parviflorum*
 Giant or English sundew - *Drosera anglica*
 Giant helleborine - *Epipactis gigantea*
 Slender cottongrass - *Eriophorum gracile*
 Green-keeled cottongrass - *Eriophorum viridicarinatum*
 Hiker's gentian - *Gentianopsis simplex*
 Northern rattlesnake-plantain - *Goodyera repens*
 Hall's rush - *Juncus hallii*
 Discoid goldenweed - *Haplopappus macronema* var. *macronema*
 Large-fruited kobresia - *Kobresia macrocarpa*
 Ausin's knotweed - *Polygonum douglasii* spp. *austiniae*
 Jove's buttercup - *Ranunculus jovis*
 Barrat's willow - *Salix barrattiana*
 Wolf's willow - *Salix wolfii* var. *wolfii*
 Shoshonea - *Shoshonea pulvinata*
 Alpine meadowrue - *Thalictrum alpinum*
 Small-flowered pennycress - *Thlaspi parviflorum*
 Californica false-hellebore - *Veratrum californicum*

Fish and Wildlife

Westslope cutthroat trout - *Oncorhynchus clarki lewisi*
 Yellowstone cutthroat trout - *Oncorhynchus clarki bouvieri*
 Montana Arctic grayling - *Thymallus arcticus montanus*
 Peregrine falcon - *Falco peregrinus*
 Northern Goshawk - *Accipiter gentilis*
 Trumpeter swan - *Cygnus buccinator*
 Harlequin duck - *Histrionicus histrionicus*
 Western big-eared bat (Townsend's) - *Plecotus townsendii*
 Flammulated owl - *Otus flammeolus*
 Black-backed woodpecker - *Picoides arcticus*
 Wolverine - *Gulo gulo*
 Northern leopard frog - *Rana pipiens*
 Boreal toad - *Bufo boreas*

ANALYSIS OF IMPACTS TO PLANT SPECIES

Sensitive Plants - Species Potentially Present

Of the 21 plant species listed for the GNF, habitat for 13 of these may exist in the area proposed for timber harvesting (Table 1). The remaining 8 species were not included in the rest of this analysis. They were excluded because the project area is above or below their elevation range, or because suitable habitat is not present. For the 13 species that may be present, their preferred habitat is very limited. Extensive habitat exists only for *Goodyera repens* (Hoffman 1998).

Table 1. GNF Sensitive Plant Species, Habitat Requirements, and Presence or Absence in the Analysis Area.

Species	Habitat	Habitat Present
<i>Adoxa moschatellina</i> Musk-root	Grows in moist, mossy areas often in rock crevices and boulder slopes that may provide protection from human activities. 4,400-5,400 feet. <i>Inhabits areas below project boundary elevations.</i>	No
<i>Aquilegia brevistyla</i> Small-flowered Columbine	Found in meadows, open woods, and rock crevices with limestone soils. 5,000-6,000 feet. <i>Inhabits areas below project area elevations.</i>	No
<i>Balsamorhiza macrophylla</i> Large-leaved Balsamroot	Grows on open hillsides. 7,000-8,500 feet. Associated with bunch grasses. Generally flowers and seeds late June through early August.	Yes
<i>Carex livida</i> Pale Sedge	In Montana, grows in sphagnum bogs and fens. 4,000-6,000 feet. <i>Inhabits areas below project area elevations.</i>	No
<i>Castilleja gracillima</i> Slender Indian Paintbrush	Located in wet meadows and along stream banks and other riparian areas. 6,700-7,000 feet. Flowers in June through late August.	Yes
<i>Cypridium calceolus</i> <i>var. parviflorum</i> Small Yellows Lady's Slipper	Occurs in damp woods, bogs, mossy seeps, and moist forest/meadow ecotones. 3,000-6,200 feet. <i>Inhabits areas below project boundary elevation.</i>	No
<i>Drosera anglica</i> English Sundew	Found in sphagnum bogs at mid-elevations in the mountains.	Yes
<i>Eleocharis rostellata</i> Beaked Spikerush	Grows in bogs. <i>Inhabits areas below project boundary elevations.</i>	No
<i>Epipactis gigantean</i> Giant Helleborine	In Montana, occurs only around thermal springs with year-round water flow, bogs, fens, and seeps. 2,000-5,750 feet. <i>Inhabits areas below project area elevations.</i>	No
<i>Eriophorum gracile</i> Slender Cottongrass	Occurs in bogs at lower elevations. <i>Inhabits areas below project area elevations.</i>	No
<i>Gentianopsis simplex</i> Hiker's Gentian	Found in mountain bogs, meadows, and seeps. 4,400-8,400 feet. Flowers in July and August.	Yes
<i>Goodyera repens</i> Northern Rattlesnake Plantain	Grows on cool north aspects characterized by spruce/twinflower or subalpine-fir/twinflower habitat types. Flowers in August.	Yes
<i>Haplopappus macronema</i> <i>var. macronema</i> Discoïd Goldenweed	Generally found growing at or above timberline (usually above 7,640 feet) in rocky, open or sparsely wooded slopes and often in talus slopes. Flowers in late July and August.	Yes

Table 1 - Continued.

Species	Habitat	Habitat Present
<i>Juncus hallii</i> Hall's Rush	Associated with montane to subalpine meadows, moist to dry meadows and slopes. 6,900-8,400 feet. Flowers in July and August.	Yes
<i>Polygonum douglasii</i> <i>var. austiniiae</i> Austin's Knotweed	Grows on open, gravelly, often shale-derived soil with eroding slopes and banks. 5,800-6,600 feet. <i>Inhabits areas below project area elevations.</i>	No
<i>Ranunculus jovis</i> Jove's Buttercup	Occurs on sagebrush slopes and open areas in spruce/fir parklands. 7,500-9,599 feet. Flowers and seeds generally set in May or June.	Yes
<i>Salix barrattiana</i> Barratt's Willow	Found growing in cold, moist soils near or above timberline especially in alpine areas. 6,800-10,500 feet. Fruits in late July or August.	Yes
<i>Salix wolfii</i> <i>var. wolfii</i> Wolf's Willow	Grows along stream banks and in wet meadows. 8,200-9,000 feet.	Yes
<i>Shoshonea pulvinata</i> Shoshonea	Grows on open, windswept limestone substrates (in thin, rocky soils) along ridges and canyon rims. 6,800-9,000 feet. Blooms in late June through July.	Yes
<i>Thalictrum alpinum</i> Alpine Meadowrue	Occurs in montane and subalpine habitats in moist, alkaline meadows, hummocky ground with shrubs present. 6,500-7,000 feet. Generally flowers and sets seeds in May and June.	Yes
<i>Veratrum californicum</i> California False-Helliborine	Found growing in wet meadows and along stream banks in montane and subalpine habitat. 5,000-8,500 feet. Flowers in July and August.	Yes

Sensitive Plants - Surveys

Sensitive plant surveys were accomplished on July 27, 30, and 31, 1998. Conditions for conducting the surveys were good in terms of plant phenology to distinguish species (Hoffman 1998). *Drosera anglica* and *Eriophorum gracile* were not specifically searched for because they were not included on the sensitive species list at that time. However, the appropriate habitat (fens and extensive bogs) to enable their existence is not present. Therefore, the surveys should still be considered adequate.

Sensitive Plants - Survey Results

No sensitive plants were found in any of the proposed timber sale units. Potential habitat for *Goodyera repens* is present, although plants were not located. *G. oblongifolia* is a common related species, but it was not observed either. Many of the sensitive species potentially occurring within the project area would be associated with the higher water table found at marshes, fens, and streams. However, very little of the proposed project area fits that description, and no sensitive species were identified at these spatially limited locations (Hoffman 1998).

Sensitive Plants - Population Status of Identified Species

No sensitive plant species were located at the project sites.

Sensitive Plants - Conclusion of Effects

For the 13 species with habitat present, implementing any of the proposed alternatives “may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species”. Reasons for this determination include survey results indicating no sensitive plants were found in the proposed harvest units. Logging would radically alter the environment in the project area, which would result in the loss of potential habitat for sensitive plant species associated with mature forests. However, this would not be consequential because these species were not found, and the amount of affected suitable habitat would be limited. In addition, the project would not involve riparian areas except for minor seeps. Therefore, effects to species associated with higher water tables would be minimal or none. Among the plant species potentially present, a chance for finding *Goodyera repens* was greatest. Because *Goodyera repens* was not found at the project site, the issue of habitat alteration would not be consequential for this species either.

Sensitive Plants - Mitigation Measures

Many sensitive plant species are associated with riparian areas. Therefore, project effects to these habitats should be avoided.

ANALYSIS OF IMPACTS TO FISH AND WILDLIFE SPECIES

Sensitive Fish and Wildlife – Habitat Requirements of Species Potentially Present

Of the 13 fish and wildlife species listed for the GNF, 8 are potentially present in the analysis area. Trumpeter swan, western big-eared bat, and flammulated owl were not included in the remainder of the analysis, primarily because of habitat limitations. Westslope cutthroat trout and Montana arctic grayling were also not included because they are not present; the analysis area is outside of their historic range.

An attempt was made to quantify existing habitat in the analysis area for some species using ArcView (GIS) and the TSMRS (timber resource) database. Database queries were developed by Wildlife Biologists Ron Krager and Joyce Whitney (Whitney and Krager 1998). Some refinements to habitat prescriptions were made in 2003 (Swain 2003). They reflect our current understanding of the habitat requirements of these species. Analysis procedures and results may change as our knowledge increases.

Yellowstone cutthroat trout: Yellowstone cutthroat trout are native to the Yellowstone River drainage. Habitat requirements include clear, cool streams with water temperatures usually under 16°C (60°F). Their habitat contains rocky, silt-free riffles for spawning, and slow, deep pools for feeding and resting. Overhanging and instream vegetation, undercut banks, logs, and large rocks provide cutthroat with hiding and resting cover (Reel et al. 1989, p. 56).

Bear Creek and many of its tributaries, including Darroch Creek, the North Fork of Bear Creek, the East Fork of Bear Creek, and Eagle Creek contain suitable habitat for Yellowstone cutthroat trout.

Peregrine falcon: Both subspecies of peregrine falcon, Arctic (*F. p. tundricus*) and American (*F. p. anatum*), are known to at least pass over the Greater Yellowstone Area (GYA) during spring and fall migration. The Arctic peregrine falcon breeds considerably to the North in the Arctic region, while the breeding range of the American peregrine falcon includes the GYA. The peregrine's preferred nest site is a rugged, remote cliff (100-300 feet in height) usually overlooking water or marshy areas where prey is plentiful. Preferred hunting areas include cropland, meadows, river bottoms, marshes, and lakes that attract abundant bird life. Peregrines may travel up to 17 miles from nesting cliffs to hunting areas (USFWS 1984, pp. 1-9).

Peregrine falcons are considered comparatively rare in Yellowstone National Park, but nesting has been documented. Reintroduction efforts have increased the number of nesting pairs within the GYA (Langelier 1989, pp. 68-69).

Suitable cliffs for nesting and good foraging habitat are present in the lowest elevations of Bear Creek. However, no nests have been reported there. These potential eyrie locations are outside of the area designated suitable for timber harvesting (MA13, see Biological Assessment, Management Area Designations). The project site does not offer nesting or foraging habitat for peregrines. Dispersing or transient birds may occasionally fly over after the nesting season. Sightings of peregrine falcons have been recorded in the lower elevations of the analysis area and adjacent drainages.

Northern goshawk: In western North America, goshawks inhabit montane stands of coniferous, deciduous, and mixed forests. They prefer tall old-growth forests during the breeding season and often nest within ¼ mile of water in forest blocks >80 hectares in size that contain openings. Nesting birds are intolerant of human disturbance and defend large areas around nest trees. They select large older trees for nest sites and often reuse them from year to year (Finch 1992). Foraging takes place in forested areas, clearings, or open fields. Their prey includes a variety of birds and mammals including species as large as grouse and rabbits (DuBois and Becker 1987, p.9).

The analysis area (Timber Subcompartments 305 and 306) contains about 2,743 acres of foraging habitat and 52 acres of nesting habitat (Swain 2003). Suitable habitat is primarily in the central part of the Bear Creek drainage and corresponds with the drier Douglas fir forests.

Harlequin duck: These ducks seek isolated, swift mountain streams. Low-gradient stream sections with dense shrubs lining the bank and braided channels may be used for nesting habitat. Aquatic invertebrates are essential as a food source. They have a low tolerance to the presence of humans (Wallen 1989, In: Clark et al. p. 61). Suitable habitat is present along Bear Creek, however it is nonexistent in the proposed harvest units.

Black-backed woodpecker: The black-backed woodpecker inhabits northern coniferous forests across North America. It is rare throughout its range, but may be locally common. Snags are required for foraging and nest sites. Foraging occurs in areas with dead and decaying trees, especially burned forests. Nest cavities may be excavated in live trees with some dead heartwood. Because of their dependence on snags, observed population increases often coincide with the aftermath of forest fires that create large stands of dead standing trees (Goggans 1989, In: Clark et al. pp. 88-89).

Suitable habitat exists in the analysis area. Although timber harvesting has reduced the availability of snags, the majority of mature forests in the drainage are still intact. The 1988 Yellowstone fires created abundant habitat in the GYA. However, the Bear Creek drainage was not involved. Fire affected areas in the drainage are limited to about 100 acres near Jardine, resulting from a more recent burn. The majority of the snags in this area are still standing. Beetle infestations are providing additional habitat progressively and, in some areas, a significant number of trees have been killed in recent years. Confirmed sightings of black-backed woodpeckers have not been reported in the analysis area.

Wolverine: Wolverines are wide-ranging and exist in low densities in large roadless or isolated areas. They use rugged, relatively inaccessible mountainous areas at high elevations in the summer and move to lower (but still snowbound) elevations in the winter. They seek areas with medium or scattered mature timber. They often hunt around small natural openings such as the edge areas between habitats, small timber pockets, and rocky, timbered benches. Dens are in well-forested areas in logjams, uprooted trees, or natural caves. Wilderness or remote country where human activity is limited appears to be essential for the maintenance of viable wolverine populations. Food availability, rather than cover type, is believed to be the primary factor in determining habitat use patterns. The scavenging life style of wolverines results in seasonally long movements and relatively large home ranges (Reel et al. 1989, pp. 32; Hash 1989, In: Clark et al. pp. 117-118).

Suitable habitat is present in the analysis area, but it has been degraded to some extent in the short-term by recent timber harvesting. However, in several decades, harvested areas will provide productive habitat for snowshoe hare and other potential prey. Current high levels of human activity may discourage wolverine presence in the roaded areas. There are an estimated 13,115 acres of suitable denning habitat present (Swain 2003).

Northern leopard frog: Northern leopard frogs are found in or near water in nonforested habitats. They prefer densely vegetated areas such as wet sedge-meadows or cattail marshes. Breeding takes place in lakes, ponds (temporary and permanent), springs, and occasionally backwaters of beaver ponds in streams (Reichel and Flath 1995). Suitable habitat exists in the analysis area but is very limited.

Boreal toad: Adult western toads are largely terrestrial and found in a variety of habitats from valley bottoms to high elevations. They breed in lakes, ponds, and slow streams where they prefer shallow areas with mud bottoms (Reichel and Flath 1995). Suitable habitat exists in the analysis area but is very limited.

Sensitive Fish and Wildlife – Surveys and Survey Results

Yellowstone cutthroat trout: Several surveys for Yellowstone cutthroat trout have been conducted throughout the Bear Creek drainage. Population surveys were completed in 1973, 1975, 1984, 1986, 1991 and 1997.

Early surveys (1973-1984) revealed the presence of Yellowstone cutthroat trout of unknown genetic status. Genetic analysis was performed in 1986 on fish collected in the North Fork of Bear Creek, the East Fork of Bear Creek, and the main stream of Bear Creek. Results showed a high degree of genetic introgression with non-native rainbow trout, which were initially stocked by the Montana Department of Fish, Wildlife and Parks in 1958. Population surveys were also completed for Darroch Creek in 1991 above a large logjam functioning as a migration barrier. Genetic analysis of fish in Darroch Creek in 1991 suggested that fish above the migration barrier were genetically pure, but the sample size was small (n = 3), so results were inconclusive. All fish sampled had the phenotypic characteristics of genetically pure Yellowstone cutthroat trout. During the extreme flood event of 1996, the migration barrier was destroyed, allowing

hybridized cutthroat trout and rainbow trout from Bear Creek to move upstream into Darroch Creek. Population surveys done during the summer of 1998 in Darroch Creek, near the proposed Harvest Units, revealed the presence of rainbow and hybrid cutthroat trout in moderate densities. Fish that appeared to be pure were analyzed. The results verified genetic purity of that subsample. In time, all Yellowstone cutthroat trout in Darroch Creek are expected to be introgressed.

Peregrine falcon: Extensive surveys for peregrine falcons were conducted in the Gardiner Basin, including Bear Creek, in 1978 (Johnson 1978) and 1991 (Davis and Heinrich 1991, Lemke 1991, and Ondov 1991). These efforts included identifying and mapping suitable habitat for eyries. Follow-up surveys were done periodically in the late 1990s (Sumner, personal communication). Peregrine falcons sightings are recorded opportunistically during other field work. No nests have been found in or near the proposed project site.

Northern goshawk: Several goshawk surveys were conducted in the vicinity of the Darroch Creek sale. The first involved the lower reaches of Pine Creek (T8S R9E, Section 3) on July 26, 1996. A pair of goshawks responded together to broadcast vocalizations there (Fitzgerald 1996). The same approximate area was surveyed on July 9, 1997. The lower 3 miles of the Pine Creek trail was also included. No visual observations or vocalizations were recorded in response to broadcast calls. An additional survey was conducted along about 0.5 miles of the nearby Bear Fork road on August 7, 1997. One goshawk responded (Tyers 1998). No nests have been found in the analysis area, including the area proposed for timber harvesting, however, it is assumed they exist in the Bear Creek drainage because of the survey responses.

Harlequin duck: The Bear Creek stream channel from the Absaroka Beartooth Wilderness boundary to its confluence with the Yellowstone River was surveyed several times in 2001, 2002, and 2003. No individuals of this species were found.

Black-backed woodpecker: This species was not found during general surveys of the project area in late 1990s. In 2003, a single individual was sighted about 9 air miles from the project site in Beattie Gulch in a burned forest (Dixon personal communication).

Wolverine: During the winter of 1998-99, specific attempts were made to survey for forest carnivores (lynx, wolverine, pine marten, and fisher). This effort included about 4.5 miles of track-intercept transects, bait-station track-plate boxes, and general reconnaissance of the area. In addition, areas containing lagomorphs (prey base for forest carnivores) were mapped by vegetation type.

Reliable wolverine sightings have been recorded in Yellowstone National Park in recent years, but the actual status and range of this species in the GYA remains uncertain (Hash 1989, In: Clark et al. p. 117; Consolo Murphy 1994, pp. 1-2). Wolverine sightings and tracks have been reported about 15 air miles southwest of the project site in Cinnabar Basin (Murphy personal communication). Contemporary surveys unrelated to the analysis for the proposed timber sale have found wolverine tracks across the Gardiner District, including all drainages from Bear Creek to Cooke City.

Northern leopard frog and boreal toad: Surveys were conducted along all the Forest Service roads and trails in the Bear Creek drainage in 2001 and 2003. No individuals of these species were found.

Sensitive Fish and Wildlife - Population Status and Viability of Identified Species

The peregrine falcon, trumpeter swan, harlequin duck, Townsends's big-eared bat, and flammulated owl either occupy microsites with very limited spatial context, are affected by a very specific type of human disturbance, or do not have suitable habitat in the analysis area. Therefore, they are not addressed in detail here.

For instance, the Townsend's big-eared bat is closely associated with caves and mines, the peregrine falcon requires cliffs for nesting, the harlequin duck requires rushing streams, and the northern leopard frog needs surface water. In most cases, these species are not affected by large-scale vegetative projects, like the proposed timber sale, as long as water quality laws are adhered to and caves, mines, and cliffs are not disturbed. The proposed harvesting would not affect these very specific habitat features.

For these reasons, the Darroch-Eagle Creek Timber Sale is compatible with protecting the viability of these species. The project does not interfere with activities to restore or protect populations or habitat at a local or landscape level.

For the remaining species, viability will be assessed in the context of the proposed project.

Yellowstone cutthroat trout: The Montana Department of Fish, Wildlife, and Parks considers the Yellowstone cutthroat trout a “Species of Special Concern”. In addition, the Forest Service lists them as a “Sensitive Species”. These designations are because the current geographic distribution of “genetically pure” Yellowstone cutthroat trout is less than 10 percent of their historic range. There are 36 remaining populations throughout their entire historic geographic range, most of which are isolated, with little potential for genetic exchange, which contributes to their decline. Competition and hybridization with non-native salmonids are also causes of the species’ decline. Non-native trout compete for food and space with native Yellowstone cutthroat trout and have been shown to displace native species. Other reasons for Yellowstone cutthroat trout’s decline throughout their historic range include habitat degradation and population fragmentation.

The Darroch Creek Yellowstone cutthroat trout population is no longer geographically isolated from non-native trout species because the log jam migration barrier is no longer present. The population is currently at a high risk of becoming introgressed with non-native rainbow and hybrid Yellowstone cutthroat trout. Non-native rainbow and hybrid cutthroat trout compete for limited food and habitat resources.

However, these factors are unrelated to the proposed timber sale. The project alternatives are designed to meet water quality standards and to protect riparian areas. Logging induced sediment increases are anticipated to be minimal. The sale is expected to meet the GNF sediment guidelines, State of Montana Water Quality Standards, Montana Forestry Best Management Practices, and Streamside Management Zone law provisions. Sediment related effects to aquatic resources are not anticipated. Therefore, the project is not expected to affect the viability of the Yellowstone cutthroat trout population.

Northern goshawk: The northern goshawk is a sensitive species for the GNF and the Forest Service Region 1, as well as a Management Indicator Species (MIS) for the GNF. Its global ranking within the Heritage Database is G5T5, which indicates it is considered globally secure (including the subspecific taxon *atripicaulis*). The Montana ranking for goshawks is S3, which is a statement of perceived vulnerability at the state level (Cherry 2003).

To address goshawk population status for the GNF, a coarse filter model was used to map potential habitat distribution. Territory components, as represented by forest vegetation, were evaluated based on the capability to support a breeding pair of goshawks. Specifically, numbers of breeding pairs that could be supported by current forest conditions, and the distribution of suitable habitat were assessed (maps available at GNF Supervisor’s Office). Modeling methods and habitat criterion are explained in Cherry (2003).

Although the model allows for predictions of habitat availability and suitability, and potential population size, it cannot determine actual numbers of birds. Therefore, the number of predicted territories that are occupied is unknown. The model does provide a baseline with respect to project related cumulative effects and may also be used to infer population viability.

Model outputs should be seen as a minimum assessment because they undoubtedly underestimate potential habitat and the associated number of birds. The model emphasizes optimal conditions for goshawk breeding territories as defined by the prescribed habitat attributes. However, less than optimal habitat may also support birds that may successfully fledge young. It is difficult to quantify the contribution of marginal habitats in supporting a stable population of northern goshawk.

The model was used to address nesting area availability Forest-wide (Table 2) and outputs represent the number of potential goshawk nests and associated territories for each mountain range in the GNF. For example, because of adequate amounts of post-fledging and foraging areas, the west slope of the Bridger Mountains was expected to support an estimated 6-10 territories. Specifically, nesting areas were predicted within north-aspect Douglas fir stands in east to west oriented drainages. Fledging habitat was a limiting factor on the east side of the Bridger Mountains, where this habitat component has been reduced by past timber harvesting. A west-slope trend for nesting territory locations was also displayed within the Crazy Mountains, where an estimated 3-5 territories may occur. The necessary forest structure

is limited on the steep east slope of this range.

Table 2. Potential Goshawk Nest Distribution on the GNF. (Cherry 2003)

Mountain Range	Potential Goshawk Territories
Bridger Mountains	6-10
Crazy Mountains	3-5
Absaroka Beartooth Range	32-63
Gallatin Range	17-36
Madison Range	10-17

The Absaroka Beartooth Mountains, which include the analysis area for the Darroch-Eagle Creek Timber Sale, have the greatest potential on the GNF to support nesting territories. This reflects large areas of potential nesting habitat present within Suce Creek, the West Boulder, and the upper portion of the Main Boulder River drainage. Potential territories are also scattered within the Deer, Deep, Mill, Six-mile, North Fork of Bear, and Horse Creek drainages. Within the southern portion of the Absaroka Beartooth Mountains, elevation and landscape-level fire effects limit potential habitat.

Potential nesting habitat and associated territories are well distributed through the Gallatin Range. Bear, Upper Bozeman, Cottonwood, Cliff and Big Creek drainages all contain extensive nesting habitat. These areas appear to be capable of supporting more than one territory each.

The largest area of potential nesting habitat within the Madison Range occurs on the west side of Hebgen Lake, including Trapper and Watson Creek drainages. Nesting goshawks were located within this area (West Lake Timber Sale, project files, Hebgen Lake Ranger District). Potential nest areas and territories were also predicted within the Beaver, Kirkwood, Red Canyon, Teepee, Hell Roaring, and Falls Creek drainages. This list is not all-inclusive; rather it indicates the distribution of potential habitat throughout the range.

Specific to the proposed Darroch-Eagle Creek Timber Sale, model outputs predict that the Bear Creek drainage may provide 1-2 goshawk breeding territories. Project implementation would not change this potential. In addition, the predictive model of goshawk habitat distribution indicates that the remainder of the Absaroka Beartooth Range may contain 32-63 nesting territories, and the rest of the GNF may contain an additional 36-68 territories, which reflects significant reproductive potential.

The project level and predictive model of goshawk habitat distribution represent two different spatial scales of analysis. At both scales, analysis indicates goshawk habitat potential would be maintained with project implementation. At the project level, no nesting habitat would be affected and 15-37 acres (depending on the alternative) of foraging habitat would be lost (Table 3). At the Forest level, northern goshawk population viability, as reflected by habitat distribution for the species, would not be impacted by project implementation.

Black-backed woodpecker: In Montana, black-backed woodpeckers are a fire-dependent species occurring primarily in burned areas, from 1 to 6 years post-fire (Hillis et al. 2002). Black-backed woodpeckers also utilize areas where disease has led to insect infestations (Saab and Dudley 1998). Black-backed woodpeckers are highly mobile and probably migrate at least 30 miles to exploit recent burns (Hoyt 2000). Fire suppression has adversely affected black-backed woodpeckers by reducing the amount of burned forest available for foraging (Hillis et al. 2002). Salvage logging can also reduce black-backed woodpecker habitat.

In Forest Service Regional 1, Hillis et al. (2002) estimated that historically, forests that were 1-6 years post-fire averaged about 2 percent of the National Forest lands. From 1940-1987, such habitat declined to only 18.8 percent of that level due to fire suppression. Large fires in 1988, 2000 and 2001 brought the average for the years 1940-2001 up to 75.4 percent of the historic level. From 1988-2001, black-backed woodpecker habitat was 284.4 percent of historic levels. Their study concluded that a few large fires contributed the vast amount black-backed woodpecker habitat. While small fires contributed few acres, they could be important for local populations (Cherry 2002).

Hillis et al. (2002) postulated that black-backed woodpeckers were negatively impacted by the period from 1940-1987, during which available habitat was at historically low levels. However, black-backed woodpecker populations are currently comparatively high within Forest Service Region 1 because of recent large fires (Hejl and McFaden 2000).

Thus, the species may have survived a bottleneck in numbers and rebounded to take advantage of newly available habitats (Cherry 2003).

The fires of 1988 burned approximately 100,000 acres (about 6 percent) of the GNF. Recent fires including the Purdy, Fridley, Beaver Creek, Monument fires, burned an additional 50,000 acres, or about 3 percent of the Forest (Shea 2003, personal communication). These fires represent significant additions to suitable black-backed woodpecker habitat. The GNF is somewhat below the Regional average for recently burned forest available to black-backed woodpeckers. However, sufficient habitat is available locally and regionally to maintain the viability of the species.

In summary, while the black-backed woodpecker may have recently gone through a population bottleneck, the current situation for this species is favorable. Increases in suitable habitat are a significant factor in this more optimistic prognosis. In this context, the proposed Darroch-Eagle Creek Timber Sale would not affect the viability of the black-backed woodpecker. The proposed project site is not currently providing primary habitat for this species. It is possible that a small number of black-backed woodpeckers could be utilizing insect and diseased forest in the vicinity for foraging. Project implementation would result in a loss of between 195-499 acres of suitable habitat, depending upon the selected alternative (Table 3). Alternative D-Modified would have the least impact on this species.

Wolverine: Wolverines are habitat generalists and forage at all elevations on carrion and mammals (Ruggiero et al. 1994, p. 114). Female wolverines den in high elevation, remote locations, usually in glacial landforms in late winter. Several studies suggest that females may be very sensitive to human disturbance at the natal den site (Hillis et al. 2003). They may move many miles when disturbed, and potentially lose their litters. In addition, there is an increasingly high demand for winter backcountry recreation of many kinds. Snowmobile technology has advanced significantly in recent years providing access into areas where formerly little if any human activity occurred. It is uncertain just how sensitive wolverines are to disturbance, and tolerances to humans may vary between individuals.

The wolverine is considered G4T4 by The Nature Conservancy, which means at both the state and global levels the species is apparently secure. However, it may be locally rare, especially in the periphery of its range (Cherry 2003).

A wolverine natal den model was developed in Region 1 (Hillis and Kennedy 2003) and overlaid on snowmobile access maps. Approximately 8 percent of public land in Region 1 fits the parameters of potential wolverine denning habitat. Forty-six percent of these areas are protected as designated Wilderness or National Park (Hillis et al. 2003).

On the GNF, there are about 950,130 acres of potential wolverine denning habitat. This represents about 50 percent of the forest. Of this, snowmobiles are excluded from about 55 percent because of Wilderness restrictions. Snowmobile access is precluded in additional uncalculated acreages because of topographic constraints (Hillis et al. 2003).

Implementing the Darroch-Eagle Creek Timber Sale would reduce wolverine denning habitat in the analysis area from 95 to 47 acres, depending on the alternative selected (Table 3). Alternative D-modified would have the least affect on this species. At the project and landscape level, this would not compromise wolverine population viability. In addition, Forest and Regional management is consistent with protecting important habitat of this species, and thus maintaining species viability.

Northern leopard frog: Habitat for the northern leopard frog is very limited within the analysis area and no individuals were found during surveys. However, it is still meaningful to discuss the process used to evaluate population concerns for this species.

The leopard frog is widely distributed in the United States and has apparently been eradicated from some of its original range (Koch and Peterson 1995, p. 84-87). Leopard frogs are associated with aquatic resources; therefore, adherence to the Montana Streamside Management Zone and Montana Water Quality Act would provide protection for this species if the project occurs. In addition, the proposed Darroch-Eagle Creek Timber Sale is likely outside the known range of the leopard frog (Maxell et al. 2003, p.60).

Boreal toads: Habitat for the boreal toad is very limited within the analysis area and no individuals were found during surveys. Populations of many amphibian species are declining worldwide, including the boreal toad (Maxell 2000, p. 10-11). Possible explanations include global warming, ozone depletion, introduced exotic predators and diseases, native predators, pesticides and chemical pollution. Maxell (2000) describes toads in Region 1 as well distributed but rare.

Toads are terrestrial during their adult life and disperse through a mix of forested habitats. They must reproduce in bodies of water, typically using ponds, lakes, and sloughs (Maxell 2000, pp. 85-100). Therefore, protection of riparian areas is critical for boreal toad population protection.

The Montana Streamside Management Zone Law and the Montana Water Quality Act protect toad breeding and nursery habitat. The Forest Service employs substantial protection policies for riparian habitats, so declines in toad populations are probably not the result of a failure to protect nursery habitat on these lands. Because of this, there is no evidence that implementing any of the proposed alternatives will jeopardize the viability of the boreal toad.

Sensitive Fish and Wildlife - Conclusion of Effects

The National Forest Management Act of 1976 and the subsequent 1982 Planning Rule mandate the maintenance of viable populations of all native and desired non-native species of vertebrates (36 CFR 219.19). The Act stipulates that viability requires sufficient numbers and distribution of reproductive individuals to enable population continuance. In addition, suitable habitat must be well distributed within the planning area to allow for interspecific contact. In this case, the planning area is defined as the area covered by the Gallatin Forest Plan.

The assessments in this document show that project implementation would not affect the viability of Forest Service sensitive species. Therefore, the GNF and the Darroch-Eagle Creek Timber Sale would comply with applicable laws, regulations, policies and standards relative to ensuring the viability of the species addressed in this analysis (Table 4).

Yellowstone cutthroat trout: Alternative A would not generate sediment or changes in riparian habitat or the hydrologic balance of area streams (Table 2), and would result in "no impact" to Yellowstone cutthroat trout. The remaining action alternatives would have "no impact" for the following reasons:

1. Existing sediment concentrations are low and estimated increases would not cause concentrations to exceed the 90 percent habitat objective.
2. The channel types are resilient to sediment increases and increases are expected to be minor.
3. There would be no riparian harvest effects.
4. The water yield increase over natural conditions would be considerably below measurable levels and would not result in stream channel scour (Shuler 1999).

Existing channel stability ratings and habitat survey data suggest that channel changes via hydrologic imbalance (bank erosion, scour, changes in channel morphology) from previous timber sales is not occurring and channels show no signs of alteration (Story 1999). Furthermore, all channel types within the analysis area have very low sensitivity to changes in streamflow or sediment discharge. In addition, silviculture prescriptions call for partial cuts in most of the units, which leaves varying percentages of trees to offset potential flow increases and related habitat effects. Thus, the determination is that there is no potential to alter hydrologic balance or cause habitat degradation and "no impact" would occur.

Peregrine falcon: Implementing any of the alternatives presented in the Environmental Assessment would not disturb individual peregrine falcons or suitable nesting or foraging habitat. The nature of the activities involved would not generate conflicts with peregrines that might compromise the viability of this species. Project implementation would have "no impact" on peregrine falcons in the analysis area.

Northern goshawk: Timber harvesting would reduce the amount of suitable goshawk foraging habitat by 15 to 37 acres (Table 3). Alternative D-Modified would have the least effect. None of the alternatives would compromise the opportunity for goshawks to nest in the Bear Creek drainage or the viability of this species at the Forest level. Therefore, it is reasonable to conclude that the project "may impact individuals or habitat, but will not likely contribute to a trend towards listing or loss of viability to the population or species".

Harlequin duck: Habitat for harlequin ducks is nonexistent at the project sites. Implementing any of the alternatives presented in the Environmental Assessment would have "no impact" on this species.

Black-backed woodpecker: Timber harvesting would reduce the amount of snags potentially available to black-backed woodpeckers in the analysis area by removing between 195-499 acres of mature forest (Table 3). Alternative D-modified would affect the least number of acres of potential habitat. However, at a landscape level, snags are plentiful in the GYA because of the effects of multiple large fires that occurred from 1988 to 2003. In addition, the species has not been observed in the analysis area. Therefore, it is reasonable to conclude that the project "may impact individuals or habitat, but will not likely contribute to a trend towards listing or loss of viability to the population or species".

Wolverine: Little information is available on wolverine in the GYA, and even less is known of the specific impact various types of projects might have on the species. However, there is evidence that wolverine are particularly vulnerable to human activities. Reasons for this include low population densities, low reproductive rates, large home ranges, and an intolerance of human presence. Low reproductive rates and low population densities suggest that human-caused mortality would be additive and not compensatory. In other words, in most cases, mortality generated by humans will add to, rather than replace, natural mortality (Ruediger 1996, pp. 1-7).

Wolverines have been present in the Gardiner Basin in recent years, although numbers are unknown. Project effects on the species would be mixed. Mature timber is important to wolverines, but they also use a wide variety of other types of habitat. Harvested areas in a matrix of mature timber may enhance wolverine habitat by also providing suitable habitat for snowshoe hare and other potential prey. In addition, their presence and distribution seems more dependent upon absence of humans and location of carrion than vegetative structure. The project would not substantially affect carrion availability, but it would affect human use levels. Harvest activities would occur for 3 years during summer months. Given the extensive ranges of these animals and the proximity of large expanses of remote areas in the Absaroka Beartooth Wilderness and Yellowstone National Park, it is unlikely that human use associated with harvest activities would significantly affect the wolverine.

Alternative D-Modified would have the least impact on wolverines. It may decrease potential denning habitat by about 57 acres (Table 3). Alternative B would remove about 95 acres of current denning habitat. Because the project has the potential to decrease wolverine denning habitat and hiding cover, and increase human activity in the short term, the determination for this species is that the project "may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species".

Northern leopard frog: Habitat for this species is limited in the analysis area and no individuals were found during surveys. The project is designed to avoid riparian areas, thus precluding impacts to suitable habitat. Implementing this proposal would have "no impact" on this species.

Boreal toad: Habitat for this species is limited in the analysis area and no individuals were found during surveys. The project is designed to avoid riparian areas, thus precluding impacts to suitable habitat. Implementing this proposal would have "no impact" on this species.

Sensitive Fish and Wildlife - Mitigation

Mitigation measures for sensitive fish and wildlife species would include:

1. Managing snags in the harvest units in accordance with direction in Forest Plan Amendment 15 (see Chapter 2, Mitigation Measures) to reduce impacts to black-backed woodpecker habitat.
2. Closing roads created by implementing the proposal to restore an environment potentially more favorable to wolverine.
3. Closing roads created through implementing the proposal to reduce sediment yield to area streams.
4. Preventing project effects to riparian areas.

Table 3. Species-Specific Effects of the Four Alternatives Studied in Detail in the EA. Where feasible, effects were quantified using ArcView (GIS) analyses of the TSMRS (timber resource) database. Database queries were developed by Wildlife Biologists Ron Krager and Joyce Whitney (Whitney and Krager 1998). Models were updated and rerun by Swain in 2003.

Species	Alternative A (No Action)	Alternative B (Proposal)	Alternative C	Alternative D	Alternative D- Modified
Yellowstone Cutthroat Trout					
Sediment	No impact.	No impact. Sediment not limiting; increases minor and within 90% management objective; stable channel types.	Same as Alt. B.	Same as Alt. B.	Same as Alt. B
Riparian harvest	No impact.	No impact. No riparian harvest proposed.	Same as Alt. B.	Same as Alt. B.	Same as Alt. B
Hydrologic balance (water yield)	No impact.	No impact. Minor increases expected; stable channel types; revegetation of old logging units.	Same as Alt. B.	Same as Alt. B.	Same as Alt. B
Harlequin Duck					
	No impact. No habitat within project area.	Same as Alt. A.	Same as Alt. A.	Same as Alt. A.	Same as Alt. A
Goshawk					
Foraging habitat (acres)	2,743	2,706 (-1.36%)	2,708 (-1.26%)	2,721 (-0.81%)	2,728 (-0.54%)
Nesting habitat	52	52	52	52	52
Wolverine					
Secondary maternal denning habitat (acres)	13,115	13,020 (-0.7%)	13,028 (-0.7%)	13,058 (-0.4%)	13,068 (-0.35%)
Black-Backed Woodpecker					
Acres of snag reduction	0	499	383	266	195

Table 4. Summary Of Conclusion Of Effects, Darroch-Eagle Creek Timber Sale.

Species	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D	Alternative D- Modified
Westslope cutthroat trout	NI	NI	NI	NI	NI
Yellowstone cutthroat trout	NI	NI	NI	NI	NI
Montana Arctic grayling	NI	NI	NI	NI	NI
Trumpeter swan	NI	NI	NI	NI	NI
Harlequin duck	NI	NI	NI	NI	NI
Peregrine falcon	NI	NI	NI	NI	NI
Western big-eared bat	NI	NI	NI	NI	NI
Northern goshawk	NI	MIIH	MIIH	MIIH	MIIH
Wolverine	NI	MIIH	MIIH	MIIH	MIIH
Flammulated owl	NI	NI	NI	NI	NI
Black-backed woodpecker	NI	MIIH	MIIH	MIIH	MIIH
Northern leopard frog	NI	NI	NI	NI	NI
<i>Adoxa moschatellina</i>	NI	NI	NI	NI	NI
<i>Aquilegia brevistyla</i>	NI	NI	NI	NI	NI
<i>Balsamorhiza macrophylla</i>	NI	MIIH	MIIH	MIIH	MIIH
<i>Carex livida</i>	NI	NI	NI	NI	NI
<i>Castilleja gracillima</i>	NI	MIIH	MIIH	MIIH	MIIH
<i>Cypridum calceolus var. parviflorum</i>	NI	NI	NI	NI	NI
<i>Drosera anglica</i>	NI	MIIH	MIIH	MIIH	MIIH
<i>Eleocharis rostellata</i>	NI	NI	NI	NI	NI
<i>Epipactis gigantea</i>	NI	NI	NI	NI	NI
<i>Eriophorum gracile</i>	NI	NI	NI	NI	NI
<i>Gentianopsis simplex</i>	NI	MIIH	MIIH	MIIH	MIIH
<i>Goodyera repens</i>	NI	MIIH	MIIH	MIIH	MIIH
<i>Haplopappus macronema var. macronema</i>	NI	MIIH	MIIH	MIIH	MIIH
<i>Juncus hallii</i>	NI	MIIH	MIIH	MIIH	MIIH
<i>Polygonum douglasii spp. Austiniae</i>	NI	NI	NI	NI	NI
<i>Ranunculus jovis</i>	NI	MIIH	MIIH	MIIH	MIIH
<i>Salix barrattiana</i>	NI	MIIH	MIIH	MIIH	MIIH
<i>Salix wolfii var. wolfii</i>	NI	MIIH	MIIH	MIIH	MIIH
<i>Shoshonea pulvinata</i>	NI	MIIH	MIIH	MIIH	MIIH
<i>Thalictrum alpinum</i>	NI	MIIH	MIIH	MIIH	MIIH
<i>Veratrum californicum</i>	NI	MIIH	MIIH	MIIH	MIIH

NI = No impact.

MIIH = May impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species.

WIFV* = Will impact individuals or habitat with a consequence that the action may contribute to a trend towards federal listing or cause a loss of viability to the population or species.

BI = Beneficial impact.

* Trigger for an extraordinary circumstance or potentially significant effect as defined in NEPA.

Prepared by:

/s/ _____ /s/ _____ /s/ _____
Wildlife Biologist Fisheries Biologist Botanist

Approved by:

/s/ _____ /s/ _____ /s/ _____
Wildlife Biologist Fisheries Biologist Botanist

Cc:

Marion Cherry, Gallatin Forest Biologist
Barb Ping, Forest Ecology Group

REFERENCES

- Cherry, M. 2003. Windmill timber sale FEIS- viability and management indicator species. On file, Gardiner Ranger District, Gallatin National Forest.
- Consolo Murphy, S. 1994. Candidate species - brief summary of status in Yellowstone. USDI Yellowstone National Park. On file, Gardiner Ranger District, Gallatin National Forest.
- Davis, S. and B. Heinrich. 1991. 1991 Gallatin National Forest peregrine survey report. USDA Forest Service. On file, Gardiner Ranger District, Gallatin National Forest.
- DuBois, K. and D. Becker. 1987. Identification of Montana birds of prey. Montana Department of Fish, Wildlife and Parks.
- Finch, D.M. 1992. Threatened, endangered, and vulnerable species of terrestrial vertebrates in the Rocky Mountain Region. General Technical Report. RM-215. Fort Collins, Colorado: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 38pp.
- Fitzgerald, G. 1996. Gallatin National Forest northern goshawk surveys. USDA Forest Service. On file, Gardiner Ranger District, Gallatin National Forest.
- Goggans, R. R. 1989. Black-backed woodpecker. pp. 88-89. In: Clark, T. W., A. H. Harvey, R. D. Dorn, D. L. Genter, and C. Groves (eds.). Rare, sensitive, and threatened species of the Greater Yellowstone Ecosystem. Northern Rockies Conservation Cooperative, Montana Natural Heritage Program, The Nature Conservancy, and Mountain West Environmental Services. 153 pp.
- Hash, H. S. 1989. Wolverine. pp. 117-118. In: Clark, T. W., A. H. Harvey, R. D. Dorn, D. L. Genter, and C. Groves (eds.). Rare, sensitive, and threatened species of the Greater Yellowstone Ecosystem. Northern Rockies Conservation Cooperative, Montana Natural Heritage Program, The Nature Conservancy, and Mountain West Environmental Services. 153 pp.
- Hejl, S.J. and M. McFaden. 2002. Maintaining fire-associated bird species across forest landscapes in the Northern Rockies. USDA Forest Service. Rocky Mountain Research Station. Forestry Sciences Lab. INT-99543-RJVA. 21 pp.
- Hillis, J.M., V.Wright, and A.Jacobs. 2002. An assessment of black-backed woodpeckers and other fire –dependent species in Region One: effects of fire suppression on habitat availability. USDA FS. Northern Rockies Region Missoula, MT. 19 pp.
- Hillis, M. and B. Kennedy. 2003. US Forest Service Region One: wolverine natal den assessment. 5 pp.
- _____, L.Young, and J. Ingebretson. 2003. Meadow Smith Project: effects and forest and regional scales-compatibility with NFMA requirements for maintaining species viability. 26 pp.
- Hoffman, T. 1998. Letter to the district ranger, sensitive plant species survey for proposed Darroch/Eagle Creek timber sale. On file, Gardiner Ranger District, Gallatin National Forest.
- Hoyt, J.S. 2000. Habitat association of Black-backed (*Picoides arcticus*) and three-toed (*P. tridactylus*) woodpeckers in the northeastern boreal forest of Alberta. Edmonton, Alberta. University of Alberta. 96 pp. PhD thesis.
- Johnson, M. 1978. Peregrine falcon survey- 1978 Gardiner Ranger District. On file, Gardiner Ranger District, Gallatin National Forest.
- Koch, E.D. and C. R. Peterson. 1995. Amphibians and reptiles of Yellowstone and Grand Teton National Parks. University of Utah Press. Salt Lake City 188 pp.

- Langelier, L. 1989. Peregrine falcon. pp. 68-69. In: Clark, T. W., A. H. Harvey, R. D. Dorn, D. L. Genter, and C. Groves (eds.). Rare, sensitive, and threatened species of the Greater Yellowstone Ecosystem. Northern Rockies Conservation Cooperative, Montana Natural Heritage Program, The Nature Conservancy, and Mountain West Environmental Services. 153 pp.
- Lemke, T. 1991. Peregrine falcon surveys in the Gardiner Basin. Montana Department of Fish, Wildlife and Parks. On file, Gardiner Ranger District, Gallatin National Forest.
- Maxell, B. 2000. Management of Montana's amphibians. A review of risk factors to population viability, species accounts: identification, taxonomy, habitat use/natural history, and status and conservation. USDA FS Northern Rockies Region. WWFRP. Missoula, Montana. 161 pp.
- Maxell, B. A., J.K. Werner, P. Hendricks, and D.L. Flath. 2003. Northwest Fauna 5. Herpetology of Montana: a history, status summary, checklists, dichotomous keys, accounts for native potentially native and exotic species and indexed bibliography. Society for Northwestern Vertebrate Biology. Olympia, Washington. 138 pp.
- Ondov, R. 1991. Peregrine falcon survey. USDA Forest Service. On file, Gardiner Ranger District, Gallatin National Forest.
- Reel, S., L. Schassberger, and W. Ruediger. 1989. Caring for our natural community: Region 1 - threatened, endangered, and sensitive species program. USDA, Forest Service, Northern Region Wildlife and Fisheries. 309 pp.
- Reichel J. and D. Flath. 1995. Identification of Montana's amphibians and reptiles. Montana Outdoors.
- Ruediger, B. 1996. The relationship between rare carnivores and highways. In: Trends in addressing transportation related wildlife mortality. Proceedings of the transportation related wildlife mortality seminar. State of Florida Department of Transportation. Tallahassee, Florida.
- Ruggiero, L.F., K.B. Aubrey, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski. 1994. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the United States. USDA FS. GTR RM-254. 184 pp.
- Saab, V.A. and J. G. Dudley. 1998. Responses of cavity-nesting birds to stand replacement fire and salvage logging in ponderosa pine Douglas-fir forests of southwestern Idaho. USDA FS Research Paper RMRS-11. USDAFS, Rocky Mountain Research Station. Ogden, Utah.
- Shuler, S. 1999. Aquatics input for Darroch-Eagle Creek timber sale. February 22. On file, Livingston Ranger District, Gallatin National Forest.
- Story, M. T. 1999. Darroch-Eagle Creek timber sale, water resource. USDA Forest Service. On file, Gardiner Ranger District, Gallatin National Forest.
- Swain, S. 2003. Methods used for wildlife queries. On file, Gardiner Ranger District, Gallatin National Forest.
- Tyers, D. 1998. Summary of 1997 goshawk surveys. On file, Gardiner Ranger District, Gallatin National Forest.
- U.S. Fish and Wildlife Service. 1984. American peregrine falcon recovery plan (Rocky Mountain/Southwest populations) prepared in cooperation with the American Peregrine Falcon Recovery Team. US Fish and Wildlife Service, Denver, Colorado. 105 pp.
- USDA, 1995. Developing biological assessments/evaluations for Forest Service activities. USDA Forest Service. On file, Gardiner Ranger District, Gallatin National Forest.
- USDA, 1997. Summary of sensitive plant surveys on the Gallatin National Forest. On file, Gardiner Ranger District, Gallatin National Forest.

USDA, 2003. Gallatin National Forest threatened, endangered, sensitive and management indicator species list. On file, Gardiner Ranger District, Gallatin National Forest.

Wallen, R. L. 1989. In: Clark, T. W., A. H. Harvey, R. D. Dorn, D. L. Genter, C. Groves eds. Rare, sensitive, and threatened species of the Greater Yellowstone Ecosystem. Northern Rockies Conservation Cooperative, Montana Natural Heritage Program, The Nature Conservancy, and Mountain West Environmental Services. 153 pp.

Whitney, J. and R. Krager 1998. Methods used for wildlife queries. April 15. On file, Forest Supervisor's Office, Gallatin National Forest.