The Status of Rare Vertebrates

in the Bighorn Landscape

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INTRODUCTION

The Bighorn Mountain region of north-central Wyoming is characterized by a broad range of elevations, climatic regimes, and land types. As a consequence, this region supports an impressive diversity of native wildlife. The Bighorn Mountains rise from about 4,000 feet to over 13,000 feet in elevation, forming a large boreo-alpine island with an almost complete compliment of forest- and tundra-associated vertebrates (e.g., American pika, white-winged crossbill). The Bighorn Basin to the west is a cold desert lying in the eastward rain-shadow of the Absaroka Mountains and the westward rain-shadow of the Bighorn Mountains, and supports several basin-adapted taxa like the white-tailed prairie dog and sage sparrow. The Powder River basin to the east is on the periphery of the Great Plains grasslands, and forms the western edge of the range of grassland obligates like least weasels and Baird's sparrows. Finally, like most areas in western North America, the stream network in the region harbors a unique assemblage of riparian and aquatic species.

Natural resources within this region are under increasing human pressure, raising concerns over the effects of resource development on biotic diversity. Suburban expansion, timber harvesting, motorized recreation, water impoundment, and other resource uses can degrade habitat quality and reduce populations of sensitive species. In order for land managers and conservation organizations to most efficiently protect biotic diversity, they need to know (1) which species are of significant conservation concern, (2) the current distribution of those species relative to existing land protection, and (3) areas supporting the highest-quality habitat for the most unprotected species. This analysis provides such information for vertebrates native to the Bighorn Mountains region.

METHODS AND RESULTS

Study area - The area covered by this analysis is the "Bighorn landscape" as defined by the Wyoming Field Office of The Nature Conservancy. This landscape is encompassed by the Montana-Wyoming border on the north, the Bighorn and Nowood rivers on the west, and U.S. interstate highways 90 and 25 on the east. The southern boundary is somewhat more diffuse, lying partially along the South Fork Powder River and continuing across the boundary between the Bighorn and Bridger mountains.

Species of conservation concern - A list of vertebrates of conservation concern (Table 1) was compiled using information from the Wyoming Natural Diversity Database (WYNDD), which maintains a database of current information on the distribution, conservation status, and habitat use of all rare and sensitive vertebrates in Wyoming. The data fields used in this list are described in Appendix A. These 85 species were listed in order of conservation concern, with species of most concern listed first. This order was determined by several characteristics of the species themselves in a 7-step process:

1. Three species are listed first because of their low GRANKs. Note that more detail on the WYNDD ranking system can be found in Fertig (1997). Mountain plovers are listed first because of their regional endemism.

2. Species with TRANK = 1 are listed next (these are also all state endemics). These are ordered first by GRANK, then by SRANK.

3. The 1 species (Yellowstone cutthroat trout) with TRANK = 2 is listed next (it is also a regional endemic).

4. The remaining regional endemics are listed next. These are ordered first by GRANK, then by PERIPH, then by SRANK.

5. The 1 remaining species (least weasel) with a disjunct population on the Bighorn landscape is listed next.

6. The remaining species with PERIPH = <blank> (i.e., species' for whom the Bighorn landscape is at the core of their range) are listed next. These are ordered first by GRANK, then by SRANK.

7. All remaining species are listed, ordered first by GRANK then by SRANK.

The 36 species remaining after step 6 are all ranked G4 or G5, are peripheral to the Big Horn landscape, and have no endemism or isolation concerns. For these reasons, these species were not considered further in this analysis; the first 49 species were considered the species of most conservation concern on the Bighorn landscape.

Evaluating current protection of species of concern - A protection rank was calculated for each of the 49 species of significant conservation concern, using a system similar to that used by the Wyoming gap analysis program (see Merrill et al. 1996). For each species, the structure, composition, and landform association of suitable habitat was determined from data within the WYNDD database (an extensive bibliography of publications on habitat use and behavior of each species is available upon request). The extent and distribution of suitable habitat on the Bighorn landscape was then estimated using paper and digital maps, and the proportion of suitable habitat that falls within each of 4 land management categories was estimated. These land management categories are:

management status 1 =	designated wilderness; preserves operated by The Nature Conservancy
management status 2 =	designated research natural areas; national monuments; wildlife habitat management areas; property under conservation easement by The Nature Conservancy
management status 3 =	multiple-use federal land (e.g., Bureau of Land Management, U. S. Forest Service)
management status 4 =	private land not under conservation easement; Wyoming state lands

These proportions were averaged with their respective management statuses to produce a final protection rank for each species. For example, for mountain plovers, 1% of all suitable habitat on the Bighorn landscape was estimated to be within status 1 lands, 15% within status 2, 30% within status 3, and 54% within status 4. Thus, the final protection rank for mountain plovers is: 1(0.01) + 2(0.15) + 3(0.30) + 4(0.54) = 3.37.

Because of their inherent mobility, most vertebrate species probably form single populations on the Bighorn landscape. A few species may occur as 2 or more populations; in these cases, the protection rank was calculated for the best-protected population on the landscape.

Appendix B provides a description of the protection ranking process, habitat distribution, priority areas, and other relevant information for each of the 49 species of conservation concern. Priority areas are areas on the landscape that provide the best habitat for that species, based on known occurrences and habitat use. In general, priority areas identify where conservation actions will probably be most effective for that particular species on this landscape. Note that when multiple priority areas are listed, they are in order of importance.

DISCUSSION

It is apparent that the current protection status of vertebrate habitat is largely a consequence of how European-Americans settled this landscape. Initial land purchases were made by agricultural interests, whose priorities were permanent water sources and productive grasslands. This has left a legacy of relatively low habitat protection for riparian, aquatic, and grassland-dependent species. Timbered lands were placed under Federal jurisdiction relatively early in the settlement period, leading to relatively high protection for boreo-alpine species. Unproductive and/ or topographically rugged country eventually came under Bureau of Land Management jurisdiction, but the high interspersion of these lands with privately owned lands resulted in medium-level protection for species using these habitats.

Other patterns emerging from this analysis:

-- Habitat in and along the Bighorn River and the lower reaches of its main tributaries is critically or potentially important for 9 of the most unprotected species in the landscape: sturgeon chub, Wilson's phalarope, white-faced ibis, Forster's tern, black tern, bald eagle, river otter, northern leopard frog, and Yellowstone cutthroat trout. Additionally, these streams probably provide the majority of foraging habitat for the 6 bats of conservation concern, especially the 3 species (Townsend's big-eared bat, fringed myotis, small-footed myotis) for which the western foothills of the Bighorn Mountains is a priority area. Conservation actions that could improve the status of these species include land purchases and easements along the streams themselves, but also the protection of native flow regimes and water quality.

-- Protection of prairie dog towns, especially large towns, is probably an efficient way to improve the status of several unprotected upland species (white-tailed prairie dogs, mountain plovers, swift fox, and burrowing owls). The southern half of the landscape probably has the highest potential to support large towns of white-tailed prairie dogs.

-- The true grasslands on the eastern and southern portions of the landscape are important for 3 unprotected grassland birds: Baird's sparrow, McCown's longspur, and grasshopper sparrow.

-- Sagebrush-dominated habitats are relatively unprotected in the landscape, as evidenced by the tenuous rankings of the sage sparrow, sage grouse, and sage thrasher populations. The western foothills of the Bighorn Mountains support large patches of sagebrush. Conservation actions within this area would benefit not only these species but, if encompassing rugged areas, may also benefit bighorn sheep and bats. Note that a similar situation exists for sagebrush habitats along the canyons of the upper forks of the Powder River.

-- Conservation actions that protect caves, abandoned mines, cliffs, and canyons are probably an efficient way to protect habitat for several bat species.

RESEARCH OPPORTUNITIES / DATA GAPS

-- The taxonomic and conservation status of Allen's thirteen-lined ground squirrel should be investigated to determine if it is a valid and extant taxon.

-- The genetic uniqueness of boreo-alpine vertebrates in the landscape should be evaluated. It is likely that several of these taxa are distinct and undescribed subspecies.

-- Northern flying squirrels and western boreal toads have never been documented on the Bighorn landscape, but are likely to occur there. Also, Canada lynx are thought to occur only as transients and not as a viable population, despite the presence of suitable habitat. Surveys for these 3 species are warranted.

-- For bats, large roosts and hibernacula need to be located. Protection of a relatively small area around critical roosts and hibernacula is probably the most efficient way to ensure the persistence of bats in the landscape.

-- Surveys for and assessments of invertebrates are needed for the entire landscape.

-- Existing conservation easements should be surveyed for species of concern. An accurate inventory of these status 2 lands would help refine the conservation ranks for several species.

LITERATURE CITED

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TABLE 1: Vertebrates of conservation concern on the Bighorn landscape, north-central Wyoming.

APPENDIX A: Description of the data fields used in the list of vertebrates of conservation concern developed for the Bighorn landscape, north-central Wyoming.

(TAX) - code for the taxonomic class of the species: F = fish, A = amphibian, R = reptile, M = mammal, B = bird. Essentially a "bookeeping" field that allows the list to be sorted on the basis of taxonomic class, if needed.

ECOREG - codes for the ecoregions in which the species occurs: NP = northern Great Plains steppe, WB = Wyoming basins, MT = Utah/ Wyoming Rocky Mountains. Refers to the species' extant range, even for species (e.g., bighorn sheep, shovelnose sturgeon) that have undergone major range contractions.

SPECIES - common name for the species.

GRANK - conservation rank (global) for the species as assigned by the Heritage network.

TRANK - conservation rank for the subspecies occurring in the Big Horn Mountains landscape. Species whose common names are preceded by "BH" (for "Bighorn") are boreo-alpine species that are probably genetically isolated on the Bighorn Mountains, and thus have been assigned TRANK = 1. In most cases, this TRANK is not yet formally recognized in the WYNDD BCD.

Note on all rank fields: "Double" ranks (e.g., G4G5) are represented in the list as fractions (e.g., 4.5).

ST ENDEM - a binary field defining whether or not the species is a state or local endemic (X = endemic, <blank> = not endemic).

REG ENDEM - a binary field defining whether or not the species is a regional endemic (X = endemic, <blank> = not endemic).

DISJUNCT - a binary field defining whether or not the population occurring within the Big Horn landscape is disjunct from adjacent populations of the species (X = disjunct, <blank> = contiguous).

PERIPH - a binary field describing the position of the Big Horn landscape in relation to the main range of the species (X = at periphery of main range, <blank> = at core of main range).

SRANK - conservation rank (state) as assigned by WYNDD. For those taxa given a TRANK, the SRANK refers to the status of the subspecies and not the species as a whole. Again, the SRANK for boreo-alpine species whose names are preceded by "BH" (for "Big Horn") is not yet formally recognized in the WYNDD BCD. Note that all migratory species (most birds and bats) are assigned 2 SRANK's in the WYNDD BCD to reflect their status during both the breeding and non-breeding seasons (e.g., S3B,S2N). In many cases these 2 ranks do not differ; in most other cases, these 2 ranks differ by only 1 level. The SRANK in the attached list is the one referring to breeding status.

WYNDD TRACK - code for the WYNDD list on which the species occurs: Y = WYNDD species of special concern list, W = WYNDD watch list.

PROT RANK - numerical rank representing the current protection of extant habitat within the Bighorn landscape.

Appendix B: Protection ranks, habitat distribution, and priority areas for 49 species of conservation concern on the Bighorn landscape, north-central Wyoming.

MOUNTAIN PLOVER ***PROTECTION RANK: 3.37***

Mountain plovers are associated with basin habitat types, and during breeding especially prefer flat areas with sparse and low vegetation. For the purpose of this analysis, mountain plovers are assumed to occur as 1 population in the landscape, extending from the grasslands east of the main Bighorn Mountains across the southern foothills to the desert-shrub environments on the west. Although the southern foothills may not support optimal habitat, they probably do not pose enough of a movement barrier to justify identifying separate populations on the east and west sides of the landscape. The protection rank refers to breeding habitat only; this species does not winter nor use special habitats during migration in the Bighorn landscape.

Habitat distribution by management status: status 1 = 1%
status 2 = 15%
status 3 = 30%
status 4 = 54%

Special concerns: Flat areas with sparse and low vegetation are preferred habitat. In shrub-dominated habitats, nesting usually occurs in grassland inclusions. Also, in some areas mountain plovers prefer nesting on prairie dog towns; protecting large prairie dog towns may help protect the mountain plover population.

Priority areas: (1) Grassland and shrub habitats on the southern half of the landscape, especially the large grassland patches to the west and southeast of the E. O. Taylor Wildlife Habitat Management Area.
(2) Grassland and shrub habitats east of the mountains from the Montana line south to Piney Creek
(3) Grassland and shrub habitats west of the mountains from the Montana line south to Paint Rock Creek.

STURGEON CHUB ***PROTECTION RANK: 3.60***

The sturgeon chub is part of a declining assemblage of prairie fish that inhabit shallow, low-elevation streams with high turbidity. In Wyoming, it occurs as 2 populations: 1 in the Powder River and 1 in the Bighorn River. The Powder River population probably does not extend far enough upstream to occur in the Bighorn landscape. Therefore, it is assumed that this species occurs as only 1 population in the landscape, in the Bighorn River above Bighorn Lake, possibly extending into the lower Nowood River. The below proportions refer to the lands immediately adjacent to these waters.

Habitat distribution by management status: status 1 = 0%
status 2 = 10%
status 3 = 20%
status 4 = 70%

Special concerns: None.

Priority areas: (1) The Bighorn and Nowood rivers from immediately above Bighorn Lake to Tensleep Creek.

SWIFT FOX ***PROTECTION RANK: 3.23***

Swift fox occur in a variety of basin habitats, including shrub-steppe, grassland, and, less frequently, the lower foothills of mountain ranges. Riparian areas are not often used, and may actually be avoided if timbered. Swift fox are assumed to form a single population on the Bighorn landscape, occupying grasslands and shrub-steppe habitats from the east side of the mountains across the southern foothills to the Bighorn Basin.

Habitat distribution by management status: status 1 = 1%

status 2 = 15%
status 3 = 44%
status 4 = 40%

Special concerns: Timbered areas, including riparian forests, may be avoided. Large treeless expanses are probably optimal. Also, in some areas swift fox preferentially use prairie dog towns; protecting large prairie dog towns may help protect the swift fox population.

Priority areas: (1) Grassland and shrub habitats on the southern half of the landscape, especially the large grassland patches to the west and southeast of the E. O. Taylor Wildlife Habitat Management Area.
(2) Grassland and shrub habitats from Paint Rock Creek north to the Montana line.

INSULAR BOREO-ALPINE VERTEBRATES

These species are strongly associated with montane and alpine habitats and, unlike other forest-associated species (e.g., Canda lynx), cannot disperse across basin environments. Populations of these species on the Bighorn Mountains have been isolated on that range for several thousand years with little if any genetic input from adjacent populations; they have therefore probably diverged to varying degrees from their "mainland" counterparts. For the purpose of this analysis, all but one (wood frog) of these species is assumed to occur as a single population in the Bighorn landscape

Special concerns: Most montane and alpine habitat in this landscape is under USFS management. It is therefore unlikely that land purchases or conservation easements will affect the protection rankof these species. Four of these species (wood frog, spotted frog, water vole, and water shrew) are semi-aquatic, and therefore conservation action on in-holdings supporting kettle ponds or marsh habitats may improve their status. For the amphibians, such action in the upper South Fork Tongue River and upper Goose Creek areas may be especially effective.

Priority areas: Boreal and alpine environments; generally above 8000 feet in elevation.

Hayden's shrew, American marten, snowshoe hare, red squirrel, southern red-backed vole — **Protection rank: 2.70**

Habitat distribution by management status:
status 1 = 3%
status 2 = 15%
status 3 =79%
status 4 = 3%

Dusky shrew — **Protection rank: 2.88**

Habitat distribution by management status:
status 1 = 3%
status 2 = 14%
status 3 = 75%
status 4 = 8%

Comments: Probably extends to lower elevations, especially along stream courses, than other forest associated species.

Spotted frog — **Protection rank: 2.25**

Habitat distribution by management status:
status 1 = 35%
status 2 = 5%
status 3 = 60%

status 4 = 0%

Wood frog **Protection rank: 2.20**

Habitat distribution by management status: status 1 = 10%
status 2 = 60%
status 3 = 30%
status 4 = 0%

Comments: Wood frogs are assumed to occur in 2 populations; 1 on upper Shell Creek, and 1 on upper Big Goose Creek / upper South Tongue River. The protection rank refers to the latter population.

Water vole **Protection rank: 2.88**

Habitat distribution by management status: status 1 = 15%
status 2 = 5%
status 3 = 77%
status 4 = 8%

Comments: Probably extends to lower elevations, especially along stream courses, than other forest-associated species.

Water shrew **Protection rank: 2.63**

Habitat distribution by management status: status 1 = 19%
status 2 = 5%
status 3 = 79%
status 4 = 3 %

American pika **Protected status:1.35**

Habitat distribution by management status: status 1 = 80%
status 2 = 5%
status 3 = 15%
status 4 = 0%

ALLEN'S 13-LINED GROUND SQUIRREL ***PROTECTION RANK: 3.26***

The taxonomic and conservation status of this subspecies is in question; it may not represent a good subspecies (initial descriptions were vague and based on only a few specimens), and it may also be extinct (has not been positively identified in the wild for at least 50 years). For the purpose of this analysis, Allen's thirteen-lined ground squirrel is considered a valid and extant taxon that occurs as a single population in the western foothills of the Bighorn Mountains.

Habitat distribution by management status: status 1 = 2%
status 2 = 3%
status 3 = 62%
status 4 = 33%

Special concerns: Note concerns over taxonomic and conservation status discussed above.

Priority areas: (1) Shrub and grassland mosaics in the southern half of landscape.
(2) Western foothills of the Bighorn Mountains the Montana line south to about Tensleep Creek.

YELLOWSTONE CUTTHROAT TROUT ***PROTECTION RANK: 3.00***

Yellowstone cutthroat trout used to occur throughout the Bighorn and Tongue river basins. Currently, only 3 streams support native populations, all on the west slope of the Bighorn Mountains: Deer Creek, Cedar Creek, and South Fork Paint Rock Creek (Kruse 1998). All of these populations lie completely within multiple use forest and adjacent BLM property; it is unclear whether the Deer Creek population, on the extreme northwestern corner of the landscape, extends far enough downstream to occur on private property. For this analysis, each population receives a protection rank of 3.0.

Habitat distribution by management status: status 1 = 0%
status 2 = 0%
status 3 = 100%
status 4 = 0%

Special concerns: Because the extant native populations are completely within USFS lands, it is unlikely that their status can be directly affected by land purchases or conservation easements. However, there is the potential to protect habitat downstream of known populations to facilitate natural or managed population expansion and future reintroductions.

Priority areas: (1) Deer Creek, Cedar Creek, and South Fork Paint Rock Creek, and reaches immediately downstream of each.

DWARF SHREW ***PROTECTION RANK: 2.34***

A single dwarf shrew has been captured within the Bighorn landscape, in a 20 year-old clearcut along upper Sourdough Creek on the southeast corner of the Bighorn Mountains. It is likely that the species is more widespread across the landscape; the regional distribution of small, cryptic, and hard-to-identify mammals is often underestimated. Based on habitat usage in other parts of Wyoming (alpine environments and open patches extending down to the montane zone), the dwarf shrew probably occurs as a single population on this landscape extending from the Cloud Peak Wilderness Area down to about the boundary of the national forest.

Habitat distribution by management status: status 1 = 30%
status 2= 8%
status 3 = 60%
status 4 = 2%

Special concerns: Similar to other boreo-alpine vertebrates (see above), dwarf shrews on the Bighorn Mountains may be isolated from adjacent populations.

Priority areas: (1) Dry and open patches from about 7500 feet in elevation up to alpine tundra.

WHITE-TAILED PRAIRIE DOG ***PROTECTION RANK: 3.23***

For this analysis, white-tailed prairie dogs are assumed to form a single population covering the western and southern portions of the landscape. This species is primarily restricted to grassland and shrub habitats below lower timber line, but occasionally occurs in large parks surrounded by forest.

Habitat distribution by management status: status 1 = 1%
status 2 = 15%
status 3 = 44%
status 4 = 40%

Special concerns: Large colonies are especially rare and should be given protection priority. Note the association of mountain plovers, swift fox, and burrowing owls with prairie dog towns.

Priority areas: (1) Grassland and shrub mosaics in the southern half of the landscape.
(2) Basin habitats from Paint Rock Creek north to the Montana line.

BAIRD'S SPARROW ***PROTECTION RANK: 3.52***

Baird's sparrow occurs as a single population in the Bighorn landscape, in the grasslands and hay-meadows on the east and southeast side of the Bighorn Mountains. The protection rank refers to breeding habitat only; this species does not winter nor depend on special habitat during migration in this landscape.

Habitat distribution by management status: status 1 = 1%
status 2 = 10%
status 3 = 25%
status 4 = 64%

Special concerns: Patches of tall grass are apparently preferred habitat.

Priority areas: (1) Grasslands on eastern side of landscape from the Montana line to about Crazy Woman Creek.
(2) Large grassland patches to the west and southeast of the E. O. Taylor Wildlife Habitat Management Area.

SAGE SPARROW ***PROTECTION RANK: 3.45***

Sage sparrows occur as a single population throughout north-central Wyoming, occurring almost exclusively in sagebrush-dominated habitats. The protection rank refers to breeding habitat only; this species does not winter nor depend on special habitat during migration in this landscape.

Habitat distribution by management status: status 1 = 1%
status 2 = 3%
status 3 = 46%
status 4 = 50%

Special concerns: None.

Priority areas: (1) Sage-dominated habitats from the Montana line south along the western foothills of the Big Horn Mountains, extending to the southwestern edge of the landscape.
(2) Sage dominated habitats immediately north and south of the town of Kaycee.

McCOWN'S LONGSPUR ***PROTECTION RANK: 3.52***

McCown's longspurs occur as a single population in the Bighorn landscape, primarily in the short- and mixed-grass prairies on the eastern side of the landscape, but also infrequently in grassland patches in the Bighorn Basin. The protection rank refers to breeding habitat only; this species does not winter nor depend on special habitat during migration in this landscape.

Habitat distribution by management status: status 1 = 1%
status 2 = 10%
status 3 = 25%
status 4 = 64%

Special concerns: None.

Priority areas: (1) Grasslands on eastern side of landscape from the Montana line to about Crazy Woman Creek.

(2) Large grassland patches to the west and southeast of the E. O. Taylor Wildlife Habitat Management Area.

WHITE-WINGED CROSSBILL ***PROTECTION RANK: 2.57***

For this analysis, white-winged crossbills are assumed to form 1 population in the Bighorn landscape, even though (as for forest bats and other forest birds) the long-term viability of this "population" may depend largely on importation of individuals from source populations to the west. This species is tied strongly to spruce and mixed conifer forests, and therefore occurs almost exclusively within multiple-use forest and the Cloud Peak Wilderness Area. The protection rank refers to year-round habitat.

Habitat distribution by management status: status 1 = 20%
status 2 = 8%
status 3 = 67%
status 4 = 5%

Special concerns: None.

Priority areas: (1) Conifer-dominated habitats above about 8000 feet in elevation.

LEAST WEASEL ***PROTECTION RANK: 3.48***

In Wyoming, least weasels are known only from the eastern base of the Bighorn Mountains near the town of Story. Known occurrences and habitat use information suggest a preference for rolling grassland hills interspersed with wet and wooded draws. This area is mostly private land, but several conservation easements have also been established here.

Habitat distribution by management status: status 1 = 0%
status 2 = 20%
status 3 = 12%
status 4 = 68%

Special concerns: This is likely a disjunct population; the nearest other population of this species occurs in western South Dakota.

Priority areas: (1) Mixture of grassland and wooded draws, below lower timber line, from about Quartz Creek south to about Clear Creek.

PEREGRINE FALCON ***PROTECTION RANK: 2.99***

All peregrine falcons breeding in Wyoming are part of a single population. Cliffs or canyon walls are primary nest substrates; eyries usually occur on southerly aspects below about 8000 feet elevation and above large streams. Breeding habitat is available in almost all major canyons draining the Bighorn Mountains. The protection rank refers to breeding habitat only; this species does not winter in this landscape, and although it may depend somewhat on waterfowl concentrations during migration, such concentrations are assumed to be less-limiting than breeding habitat.

Habitat distribution by management status: status 1 = 10%
status 2 = 8%
status 3 = 55%
status 4 = 27%

Special concerns: Peregrine falcons tend to return to the same eyries year after year, and reoccupation of historic eyries is commonly observed as populations expand. Eyries known to be active at any time should receive protection priority.

Priority areas: (1) Cliffs, canyon walls, and major escarpments with any southern exposure from the Montana line south to Tensleep Canyon.
(2) Rock walls with any southern exposure along the canyons of the 3 forks of the upper Powder River.

TOWNSEND'S BIG-EARED BAT ***PROTECTION RANK: 2.91***

Townsend's big-eared bat occurs in a wide variety of habitat types from desert shrub to dry conifer forest, and is assumed to form a single population in the Bighorn landscape. As with many other bats the limiting habitat element is not vegetation type, but suitable roosting and hibernating structures. Although rock-outcrops and buildings are sometimes used as night roosts, caves and abandoned mines appear to be preferred for roosts and hibernacula. This species is known to hibernate in Wyoming, but it is unclear whether hibernation in the Bighorn landscape (or Wyoming in general) is critical to population status. The majority of the Bighorn population may hibernate elsewhere; therefore, the protection rank refers to summer habitat.

Habitat distribution by management status: status 1 = 12%
status 2 = 10%
status 3 = 53%
status 4 = 25%

Special concerns: Cliffs, canyons, buttes, and other landforms that may support caves and rock crevices should be given priority, especially when in close proximity to open water or wetlands (i.e., foraging habitat). Known roosts and hibernacula should receive high protection priority.

Priority areas: (1) The foothills of the Bighorn Mountains, especially the canyons and escarpments from the Montana line south to Tensleep Canyon.
(2) Canyons along the upper 3 forks of the upper Powder River.

BLACK TERN ***PROTECTION RANK: 3.49***

Black terns occurring in the Bighorn landscape are part of a single population. Lakes/ reservoirs, ponds, or marshes below about 7500 feet elevation are typical breeding habitat; large rivers may also be used. The protection rank refers to breeding habitat only; this species does not winter in this landscape, and stopover-habitat (lakes, rivers, and wetlands in general) is assumed to be less limiting than breeding habitat.

Habitat distribution by management status: status 1 = 5%
status 2 = 9%
status 3 = 18%
status 4 = 68%

Special concerns: None.

Priority areas: (1) Lakes/ reservoirs, ponds, and large wetlands throughout the landscape. Wetlands and backwaters along the Bighorn River may be especially important.

BALD EAGLE ***PROTECTION RANK: 3.55***

For the purposes of this analysis, bald eagles in the Bighorn landscape are assumed to be part of a single population. Bald eagles breed in coniferous and deciduous forests bordering large rivers and lakes, and require large trees as nesting substrate. The protection rank refers to breeding habitat only; although bald eagles winter in and migrate through the Bighorn landscape, habitat is assumed to be most limiting during the breeding season.

Bald eagles are known to breed in the riparian forest along the Bighorn and Nowood rivers, and the lower reaches of their major tributaries. Other possible breeding habitat includes the gallery forests along Piney Creek, Rock Creek, Clear Creek, Middle Fork Powder River, and the Tongue River and the lower stretches of its major tributaries. The protection rank refers to the status of all of these areas combined. Note that if the analysis is restricted to just the

Bighorn and Nowood rivers, the status does not change appreciably (i.e., the proportions of habitat in the different management categories is about the same).

Habitat distribution by management status: status 1 = 0%
status 2 = 10%
status 3 = 25%
status 4 = 65%

Special concerns: Bald eagles return to traditional nest sites year after year. Nests that have been active in previous years should be given protection priority.

Priority areas: (1) Riparian forests near the upper portion of Bighorn Lake and along the Bighorn and Nowood Rivers.
(2) Riparian forests along Piney Creek, Rock Creek, Clear Creek, Middle Fork Powder River, and the Tongue River and the lower stretches of its major tributaries.

BURROWING OWL ***PROTECTION RANK: 3.23***

For this analysis, burrowing owls are assumed to form a single population on the Bighorn landscape. This species is strongly associated with prairie dog towns, and black-tailed prairie dog towns on the eastern portion of the landscape blend relatively seamlessly with white-tailed prairie dog towns to the west. Any gaps would still support thirteen-lined ground squirrels, whose burrows are also used by burrowing owls. Although grassland habitats are preferred, shrub habitats are used as well. Agricultural types with grassland structure are also used, probably with variable reproductive success. The protection rank refers to breeding habitat only; this species does not winter nor depend on special habitat during migration in this landscape.

Habitat distribution by management status: status 1 = 1%
status 2 = 15%
status 3 = 44%
status 4 = 40%

Special concerns: Burrowing owls are strongly associated with prairie dog towns; protecting large prairie dog towns will help protect the burrowing owl population.

Priority areas: (1) Grassland and shrub habitats on the southern half of the landscape, especially the large grassland patches to the west and southeast of the E. O. Taylor Wildlife Habitat Management Area.
(2) Grassland and shrub habitats east of the mountains from the Montana line south to Piney Creek
(3) Grassland and shrub habitats west of the mountains from the Montana line south to Paint Rock Creek.

BIGHORN SHEEP ***PROTECTION RANK: 2.90***

Bighorn sheep used to occur throughout the Bighorn landscape, including escarpments in the Bighorn Basin and the entire Bighorn Mountain range from the tundra to lower foothills. Currently, small and tenuous groups of sheep occur in the Shell Canyon area and the Devil Canyon/ Bighorn Lake area. Also, herds near the Wind River Canyon may occasionally contribute a few transients to the southwestern part of the landscape. None of these occurrences are considered viable populations. Therefore, this analysis is based on the 4 areas that support the best remaining bighorn sheep habitat in the Bighorn landscape: Shell Canyon, Paintrock Canyon, Tensleep Canyon, and the area west of the town of Kaycee along the canyons of the forks of the upper Powder River.

A 1997 analysis (Hughes 1997) identified these 4 areas with the goal of facilitating future mountain sheep reintroductions, which are highly likely to occur. Within each area, high-quality habitat complexes were identified based on the proximity of escape terrain, lambing habitat, summer range, and winter range. Currently, the best protected complexes occur in the Tensleep Canyon area; the protection rank refers to this area.

Habitat distribution by management status: status 1 = 10%
status 2 = 10%
status 3 = 60%
status 4 = 20%

Special concerns: In western North America, populations of bighorn sheep suffer from 3 main problems: (1) disease transmission from domestic livestock; (2) re-forestation of migration corridors (a consequence of fire suppression); and (3) loss of security due to expanding road networks and accompanying human presence. Therefore, areas that are free of livestock, support open habitats (i.e., shrublands and grasslands) across a broad elevational range, and have few roads should be given protection priority.

Priority areas: (1) Shell Canyon, Paint Rock Canyon, Tensleep Canyon, and the canyon country along the upper forks of the Powder River.

WHITE-FACED IBIS ***PROTECTION RANK: 3.41***

White-faced ibis in the Bighorn landscape are assumed to be part of a single population. This bird breeds in marshes, irrigated meadows, and well-vegetated lake margins below about 7500 feet in elevation. The protection rank refers to breeding habitat only; this species does not winter in this landscape, and stopover-habitat (lakes, rivers, and wetlands in general) is assumed to be less limiting than breeding habitat.

Habitat distribution by management status: status 1 = 5%
status 2 = 12%
status 3 = 20%
status 4 = 63%

Special concerns: None.

Priority areas: (1) Lakes, ponds, wetlands, and irrigated meadows throughout the landscape. Wetlands and irrigated fields along the Bighorn River may be especially important.

LONG-EARED MYOTIS ***PROTECTION RANK: 2.79***

Primary habitat for long-eared myotis is coniferous forest; specifically, stands with high availability of large trees and large snags for roosting. Cliffs, caves, abandoned mines, and buildings within the conifer zone may also be used as roosts. This species is assumed to form 1 population in the Bighorn landscape. The protection rank refers to breeding habitat only; hibernation has not been documented in the state.

Habitat distribution by management status: status 1 = 13%
status 2 = 8%
status 3 = 66%
status 4 = 13%

Special concerns: Cliffs, canyons, buttes, and other landforms that may support caves and rock crevices should be given priority, especially when in close proximity to open water or wetlands (i.e., foraging habitat). Known roosts should receive high protection priority.

Priority areas: (1) Conifer-dominated habitats above about 7500 feet elevation, especially late-seral stands, burned stands, or stands near canyons or rock outcrops.

FRINGED MYOTIS ***PROTECTION RANK: 3.08***

Fringed myotis generally occur below 7500 feet in ponderosa, juniper, and shrub habitats, and form a single population in the Bighorn landscape. Within these habitats, caves, abandoned mines, rock crevices, tree cavities, and buildings are used as roosts. Foraging occurs in a wide variety of vegetation patches. This species is known to

hibernate in Wyoming, but it is unclear whether hibernation in the Bighorn landscape (or Wyoming in general) is critical to population status. The majority of the Bighorn population may hibernate elsewhere; therefore, the protection rank refers to summer habitat.

Habitat distribution by management status: status 1 = 3%
status 2 = 11%
status 3 = 61%
status 4 = 25%

Special concerns: Cliffs, canyons, buttes, and other landforms that may support caves and rock crevices should be given priority. Known roosts and hibernacula should receive high protection priority.

Priority areas: (1) Foothills around the fringe of the Bighorn Mountains, especially the canyons and escarpments from the Montana line south to Tensleep Canyon.
(2) Canyons along the upper 3 forks of the Powder River.

FORSTER'S TERN ***PROTECTION RANK: 3.49***

All Forster's terns in Wyoming likely form a single population, and breed in lakes, marshes, and reservoirs below 7500 feet. The protection rank refers to breeding habitat only; this species does not winter in this landscape, and stopover-habitat (lakes, rivers, and wetlands in general) is assumed to be less limiting than breeding habitat.

Habitat distribution by management status: status 1 = 5%
status 2 = 9%
status 3 = 18%
status 4 = 68%

Special concerns: None.

Priority areas: (1) Lakes/ reservoirs, ponds, and large wetlands throughout the landscape. Wetlands and backwaters along the Bighorn River may be especially important.

HOARY BAT ***PROTECTION RANK: 2.85***

Hoary bats occur in a broad range of habitat types, from the lowest basins to about 10,000 feet in elevation. Hoary bats in the Bighorn landscape are assumed to be part of a single population. Both deciduous and coniferous trees are used for roosting; therefore this analysis concentrates on timbered habitats at all elevations. The protection rank refers to summer habitat only; this species is thought to migrate out of the Bighorn landscape before winter.

Habitat distribution by management status: status 1 = 11%
status 2 = 13%
status 3 = 56%
status 4 = 20%

Special concerns: Known roosting sites should receive high protection priority.

Priority areas: Difficult to determine due to broad habitat tolerance; low-elevation forests such as cottonwood-willow communities may be most important.

PYGMY NUTHATCH ***PROTECTION RANK: 3.14***

Pygmy nuthatches are strongly associated with ponderosa pine, and are assumed to form a single population in this timber-type around the fringe of the Bighorn Mountains. The majority of this habitat is managed as multiple-use forest; some is contained within TNC easements and the TNC preserve at Tensleep. The protection rank refers to year-round habitat.

Habitat distribution by management status: status 1 = 1%
status 2 = 15%
status 3 = 53%
status 4 = 31%

Special concerns: None.

Priority areas: (1) The ponderosa pine forest extending from the Montana line south along the base of the Bighorn Mountains to about the Middle Fork of the Powder River.
(2) The ponderosa pine forest east-northeast of the town of Tensleep.

NORTHERN LEOPARD FROG ***PROTECTION RANK: 3.12***

Northern leopard frogs occupy a broader range of elevation and habitat than either spotted or wood frogs, and are probably more widespread on the Bighorn landscape than WYNDD data implies (5 documented occurrences from the eastern half and southwestern quarter of the Bighorn National Forest). For this analysis, this species is assumed to form a single population in the Bighorn landscape. Northern leopard frogs occur in marshes, beaver ponds, and the margins of ponds, lakes, and streams from the plains through the montane zone.

Habitat distribution by management status: status 1 = 5%
status 2 = 9%
status 3 = 55%
status 4 = 31%

Special concerns: None.

Priority areas: (1) Wetlands of all types, including stream and lake margins, throughout the landscape.

NORTHERN GOSHAWK ***PROTECTION RANK: 2.65***

Northern goshawks occur as a single population in the Bighorn landscape. They nest preferentially in conifer or aspen stands with large, well-spaced trees and little mid- and understory vegetation. Late-seral stands of lodgepole pine are preferred for nesting in some areas. Although some of this habitat is protected within the Cloud Peak Wilderness Area, most occurs in multiple-use forest. The protection rank refers primarily to breeding habitat; although this species does winter in the Bighorn landscape, it occupies a broader range of habitats (i.e., occurs in lower-elevation areas) in winter than in the breeding season.

Habitat distribution by management status: status 1 = 15%
status 2 = 10%
status 3 = 70%
status 4 = 5%

Special concerns: Goshawks tend to return to traditional nest sites year after year; known nests should receive high protection priority.

Priority areas: (1) Conifer habitats (especially late-seral lodgepole pine) above about 7500 feet in elevation.

WILSON'S PHALAROPE ***PROTECTION RANK: 3.41***

Wilson's phalarope breeds in a variety of wetland types, including river margins, mudflats, shallow lakes and marshes. Flooded pastures are sometimes used for feeding. They generally occur below about 7500 feet in elevation. The protection rank refers to breeding habitat only; this species does not winter in this landscape, and stopover-habitat (lakes, rivers, and wetlands in general) is assumed to be less limiting than breeding habitat.

Habitat distribution by management status: status 1 = 5%
status 2 = 12%

status 3 = 20%
status 4 = 63%

Special concerns: None.

Priority areas: (1) Lakes/ reservoirs, ponds, wetlands, and river margins throughout the landscape. Wetlands and backwaters along the Bighorn River may be especially important.

SHORT-EARED OWL ***PROTECTION RANK: 3.32***

Short-eared owls occur in a variety of grassland types, especially when near marshes or irrigated meadows, and also in shrublands. Based on the latter association, it is assumed that they form a single population in the Bighorn landscape, with east-west connectivity achieved across the foothills on the southern part of the landscape. The protection rank refers to year-round habitat.

Habitat distribution by management status: status 1 = 1%
status 2 = 15%
status 3 = 35%
status 4 = 49%

Special concerns: Grasslands appear to be preferred over shrublands, and areas near wetlands appear to be preferred over more upland situations.

Priority areas: (1) Grass and shrub dominated habitats on eastern side of landscape from the Montana line south to about Crazy Woman Creek.
(2) The southern half of the landscape, particularly the large grassland patches to the west and southeast of the E. O. Taylor Wildlife Habitat Management Area.
(3) Basin habitats from the Montana line south to about Paint Rock Creek.

WILLIAMSON'S SAPSUCKER ***PROTECTION RANK: 2.65***

Williamson's sapsucker is associated primarily with coniferous forest, especially stands with high availability of large snags (e.g., late-seral stands, burned stands, aspen inclusions). This species occurs as a single population in the Bighorn landscape. The protection rank refers to breeding habitat only; this species does not winter in nor depend on special habitat during migration in this landscape.

Habitat distribution by management status: status 1 = 15%
status 2 = 10%
status 3 = 70%
status 4 = 5%

Special concerns: None.

Priority areas: (1) Conifer habitats (especially late-seral stands, burned stands, or aspen inclusions) above about 7500 feet in elevation.

SAGE THRASHER ***PROTECTION RANK: 3.38***

Sage thrashers are primarily sagebrush associates, but also occur in other shrub types (e.g., greasewood, saltbush). Grassland and juniper communities are marginal habitats. As with short-eared owls, a single population is assumed to occur in the Bighorn landscape, with east-west connectivity provided by the shrublands on the southern end of the landscape. The protection rank refers to breeding habitat only; this species does not winter nor depend on special habitat during migration in this landscape.

Habitat distribution by management status: status 1 = 1%
status 2 = 7%

status 3 = 45%
status 4 = 47%

Special concerns: None.

Priority areas: (1) Sage-dominated habitats from the Montana line south along the western foothills of the Big Horn Mountains, extending to the southwestern edge of the landscape.
(2) Sage dominated habitats immediately north and south of the town of Kaycee.

GRASSHOPPER SPARROW ***PROTECTION RANK: 3.52***

Grasshopper sparrows breed most commonly in mixed-, tall-, and short-grass prairies. Hayfields and fallow croplands are also used. This species appears limited to elevations below about 6200 feet and usually does not breed in shrub-dominated environments. It is assumed to occur in 2 populations on the Bighorn landscape: 1 in the grasslands along the eastern base of the Bighorn Mountains, and one in grassland and agricultural types in the Bighorn Basin. The protection rank refers to breeding habitat in the former population. This species does not winter nor depend on special habitat during migration in this landscape.

Habitat distribution by management status: status 1 = 1%
status 2 = 10%
status 3 = 25%
status 4 = 64%

Special concerns: Patches of tall grass appear to be preferred habitat.

Priority areas: (1) Grasslands on eastern side of landscape from the Montana line to about Crazy Woman Creek.
(2) Large grassland patches to the west and southeast of the E. O. Taylor Wildlife Habitat Management Area.

BREWER'S SPARROW ***PROTECTION RANK: 3.18***

Brewer's sparrows probably occur in most shrub-dominated habitats in Wyoming, and all shrub-dominated habitats in the Bighorn landscape. They form a single population in the landscape, extending from the lowlands through the foothills into shrub parklands within the montane zone. The protection rank refers to breeding habitat only; this species does not winter nor depend on special habitat during migration in this landscape.

Habitat distribution by management status: status 1 = 1%
status 2 = 6%
status 3 = 67%
status 4 = 26%

Special concerns: None.

Priority areas: (1) Shrub-dominated habitats from the Montana line south along the western foothills of the Big Horn Mountains, expanding south of Tensleep Creek to encompass the southern half of the landscape.

LONG-LEGGED MYOTIS ***PROTECTION RANK: 2.79***

Long-legged myotis are associated with montane environments, extending from juniper-shrub communities up through sub-alpine forests, and are assumed to form a single population in the Bighorn landscape. Within this zone, a variety of structures (tree cavities, snags, buildings, caves, abandoned mines, rock crevices) are used for roosting. The protection rank refers to breeding habitat; hibernation has not been documented in Wyoming.

Habitat distribution by management status: status 1 = 13%
status 2 = 8%

status 3 = 66%
status 4 = 13%

Special concerns: Cliffs, canyons, buttes, and other landforms that may support caves and rock crevices should be given priority, especially when in close proximity to open water or wetlands (i.e., foraging habitat). Known roosts should receive high protection priority.

Priority areas: (1) Forests and forest/ shrub mosaics above about 6000 feet in elevation, especially when near canyons or rock outcrops.

SMALL-FOOTED MYOTIS ***PROTECTION RANK: 2.91***

Small-footed myotis occur predominantly at low- to mid-elevations, from sagebrush steppe through the foothills into the lower montane zone. Canyon and butte habitats appear to be preferred, and a variety of structures (tree cavities, caves, abandoned mines, rock crevices) are used for roosting. For this analysis it is assumed that small-footed myotis occur as a single population on the Bighorn landscape. The species is known to hibernate in Wyoming, but it is unclear whether hibernation in the Bighorn landscape (or Wyoming in general) is critical to population status. The majority of the Bighorn population may hibernate elsewhere; therefore, the protection rank refers to summer habitat.

Habitat distribution by management status: status 1 = 12%
status 2 = 10%
status 3 = 53%
status 4 = 25%

Special concerns: Cliffs, canyons, buttes, and other landforms that may support caves and rock crevices should be given priority, especially when in close proximity to open water or wetland (i.e., foraging habitat). Known roosts and hibernacula should receive high protection priority.

Priority areas: (1) Foothills around the fringe of the main Bighorn Mountains, especially the canyons and escarpments from the Montana line south to Tensleep Canyon.
(2) Canyons along the upper 3 forks of the Powder River.

SILVER-HAIRED BAT ***PROTECTION RANK: 2.85***

Silver-haired bats occupy a broad range of habitats from the plains to the sub-alpine zone, and form a single population in the Bighorn landscape. Documented roosting structures include buildings, caves, crevices, and wood/ slash piles. In the Black Hills, silver-haired bats preferred roosting in mature stands of ponderosa pine, where large trees and snags were available. Foraging typically occurs over streams and ponds. The protection rank refers to breeding habitat; this species is thought to migrate out of the Bighorn landscape prior to winter.

Habitat distribution by management status: status 1 = 11%
status 2 = 13%
status 3 = 56%
status 4 = 20%

Special concerns: Cliffs, canyons, buttes, and other landforms that may support caves and rock crevices should be given priority, especially when in close proximity to open water or wetland (i.e., foraging habitat). Known roosts should receive high protection priority.

Priority areas: Difficult to determine due to broad habitat tolerance; ponderosa pine forests near canyons and buttes may be most important.

RIVER OTTER ***PROTECTION RANK: 3.43***

Prior to Euro-American settlement, river otters occurred in almost all streams in the Bighorn landscape. Although suitable habitat still exists, otters have been documented only infrequently in the landscape in recent years. The most suitable habitat probably occurs along the main Bighorn River and the lower reaches of its major tributaries (Lindzey, personal communication); this is also where otters have been most reliably sighted in recent years. Also, the Bighorn River is directly accessed by sub-adults dispersing from source populations in the Absaroka / Yellowstone Plateau country. The Little Bighorn, Tongue, and Powder rivers contain suitable habitat, but are not as directly connected to source populations. Otters have been sighted very infrequently on the upper Powder River in recent years. For this analysis, otters are assumed to occur only in the major streams on the west side of the Bighorn Mountains.

Habitat distribution by management status: status 1 = 0%
status 2 = 17%
status 3 = 23%
status 4 = 60%

Special concerns: At a regional scale, populations are expanding outward from northwestern Wyoming (where populations survived the historic decline) and northern Colorado (where reintroductions have taken place). Combined with the relatively high potential for future reintroductions, this suggests that protecting habitat on both sides of the Bighorn Mountains to facilitate population establishment is a valid conservation action.

Priority areas: (1) The Bighorn River above Bighorn Lake, and the lower reaches of its main tributaries.
(2) The upper forks of the Powder River., and the Tongue River.

SAGE GROUSE ***PROTECTION RANK: 3.45***

Sage grouse occur in sagebrush-dominated habitats from the basins to the foothills, and are assumed to occur as a single population in the Bighorn landscape. The protection rank refers to year round habitat.

Habitat distribution by management status: status 1 = 1%
status 2 = 3%
status 3 = 46%
status 4 = 50%

Special concerns: Sage grouse are faithful to traditional lek sites; known leks should receive high protection priority.

Priority areas: (1) Sage-dominated habitats from the Montana line south along the western foothills of the Big Horn Mountains, extending to the southwestern edge of the landscape.
(2) Sage dominated habitats immediately north and south of the town of Kaycee.

GOLDEN-CROWNED KINGLET ***PROTECTION RANK: 2.65***

Golden-crowned kinglets are strongly associated with spruce-fir forests, especially near permanent streams, in the breeding season. Therefore they occur primarily in multiple use forest and the Cloud Peak Wilderness Area in this landscape. The protection rank refers primarily to breeding habitat; although they winter in the Bighorn landscape, they occur in a broader range of habitats and elevation zones in the winter.

Habitat distribution by management status: status 1 = 15%
status 2 = 5%
status 3 = 80%
status 4 = 0%

Special concerns: None.

Priority areas: (1) Conifer forests (especially spruce-fir forests) above about 8000 feet in elevation.