

DRAFT Appendix B

Selection Process for Management Indicator Species

INTRODUCTION AND BACKGROUND

As directed in the 1982 NFMA (National Forest Management Act) planning regulations at 36 CFR 219.19, the Bighorn Revised Forest Plan must select and identify monitoring practices for Management Indicator Species (MIS), and the Environmental Impact Statement (EIS) must show the estimated effects of projected management actions. This document describes the steps used in selecting MIS and establishing monitoring for MIS. The process used follows the Regional guidance paper developed by Hayward et al (2001). The two main sections of this document are the *guiding principles* and the *seven selection steps*. Through this process, six species were selected as MIS for the revised plan, including **elk, rainbow trout, beaver, red squirrel, red-breasted nuthatch, and Brewer's sparrow**.

This introduction section summarizes the MIS concept generally employed in forest planning, its criticisms, and the previous use of MIS on the Bighorn National Forest. As described in Hayward et al (2001)¹, MIS is a concept adopted by the Forest Service to serve as a barometer for species viability at the Forest level (planning area). Originally described in the planning regulations, the MIS concept was further described through agency manual guidance (FSM 2600). Plant and animal species, communities, and habitats can be considered. Species to consider may include: threatened or endangered species, species with consumptive uses, non-game species of special interest, species with special habitat needs influenced by management activities, and species whose population changes may indicate effects on other species.

Applying MIS in forest planning presents several challenges (Hayward et al 2001). Species are often affected by factors other than management activities. MIS may not represent other species within a given guild or habitat type. MIS may also use habitat in different ways depending on seasonal requirements. In addition, considerations of feasibility of monitoring and funding availability for monitoring limit the implementation of the concept. Finally, not all monitoring of species and habitats implemented for forest plans fit the goals and objectives of MIS monitoring as described in the regulations.

As this is a revision of the 1985 Forest Plan, it is necessary to review of the status and use of the MIS concept under the existing Plan. The 1985 Plan identified 24 terrestrial wildlife species as MIS, separated into seral community associations, to describe the effects of alternatives (pages II-45, 46). Within the 1985 Plan, direction stated that MIS would include deer, elk, and any federally threatened or endangered species. In addition, the Plan identified nine other categories with which to select MIS, presumably to make project level analysis and monitoring easier (pages II-35, 36). The 1985 Plan, including amendment #4, only identified habitat monitoring for MIS, though big game and peregrine falcon population monitoring measures were also included (page IV-5). Population monitoring has since been clarified as a necessary component of MIS.

¹ Hayward, G.H., et al. 2000. Draft process to evaluate species and population viability in forest planning and plan implementation in the Rocky Mountain Region. USDA Forest Service. Lakewood, CO. 9 pp.

The uncertainty of a clear designation of MIS with regard to the 24 species in the 1985 plan, and the lack of population monitoring conducted for species other than the three mentioned above, led the Forest to conduct a review of its MIS species in 2001 (USDA 2001). Using current scientific literature, this review focused on evaluating the 24 species in the 1985 plan with regard to their suitability as MIS, and the feasibility of conducting forest-wide monitoring of populations for each species. Six species were recommended for continued project level analysis and for forest-wide monitoring. These included elk, red squirrel, lark sparrow, white-crowned sparrow, red-breasted nuthatch, and the three-toed woodpecker. In addition, recommendations for monitoring and considerations for other species and communities to be evaluated during the current Plan revision were identified. In 2002, the Forest undertook an amendment to the 1985 Plan to incorporate these recommendations with the anticipation that change was needed prior to the completion of the revision process. The Environmental Assessment and Decision Notice for this non-significant amendment, and the corresponding plan amendment (#15) were completed in September 2002 (USDA 2002). Population trend monitoring for red squirrels and avian species was also begun in 2002.

In order to begin the revision process and to encourage involvement from other agencies, the Forest prepared an initial document describing Species Emphasis Categories. This document explained the different categories (TES, Demand, Species of Local Concern, and MIS), compiled existing species lists, and made initial assessments for categorizing species. Input on the initial list was obtained from the Wyoming Natural Diversity Database, professional botanists, and the Wyoming Game and Fish Department (WGFD). This [Species Emphasis Categories](#) document was then revised from feedback received. [Species Assessments](#) were also prepared, or are in the process of completion for each species listed in one of the emphasis categories to provide information and documentation for viability analysis. The [Species Viability Assessment](#) document explains the overall process of how viability will be addressed in the plan revision. These latter two documents will not be completed until the DEIS is released.

Following are the elements specific to the selection of MIS for the revised Plan. Specialists from the botany, aquatic, and terrestrial wildlife functions on the Forest were involved in the selection process. In general, the process was one of a compilation of monitoring needs for species and habitats, rather than a process of elimination starting with a list of all species that may occur on the Forest.

GUIDING PRINCIPLES

In Hayward et al (2001), five principles are described to guide the selection of MIS. These are displayed below, with the corresponding information relevant to the Bighorn National Forest.

1) Principle 1 -- Choose MIS to reflect major management issues and challenges.

The major management issues on the Bighorn were identified by the interdisciplinary planning team and through public scoping. Environmental conditions that pose challenges were identified through the watershed assessments, and by the terrestrial and aquatic ecosystem assessments

conducted by the Regional Office. In addition, five major revision issues were identified to guide alternative development for the DEIS and other processes associated with the environmental analysis, each of which have viability implications for species. From these sources, the following issues and challenges applicable to species viability and management were identified:

- Effects of commodity outputs and human uses including timber harvest, livestock grazing, recreation use, and the associated road and trail networks.
- Importance of riparian habitat, watershed, and water quality related functions.
- Lack of information regarding species of limited distribution or with limited habitat requirements.
- Importance of old growth spruce/fir and all aspen habitat.
- Lack of ability to proactively manage habitats to maintain structural diversity, including forested and non-forested (shrub) communities.
- Effects of non-native species including habitat loss from noxious weeds or other invasive species, and habitat losses from non-native diseases such as White Pine Blister rust.

2) Principle 2 -- *MIS function to facilitate evaluation.*

MIS should facilitate the Forest's ability to evaluate effects of land management actions; in the current plan revision effort and into the future as projects are implemented. The major activities likely to occur on the Forest in the next planning period are livestock grazing, timber harvest, recreation use, and prescribed burning. In order to facilitate evaluation, the species selected should also correspond to a forest-wide condition or need, and project level feasibility. Habitat aspects would be best evaluated if they can either be modeled and/or tracked through GIS systems and remote sensing due to the likelihood of continuing improvements and availability of this technology. The population-monitoring requirement of the regulations should also contribute to this function.

3) Principle 3 -- *Consider MIS chosen on neighboring planning units.*

As the Bighorn National Forest (NF) is isolated from other National Forests, this factor is not as relevant. The Forest is surrounded by private, State, Crow Indian Reservation and lands managed by the Bureau of Land Management, none of which use the MIS concept. The Shoshone NF, the next closest National Forest, has not yet revised its Forest Plan for new MIS, and has an older list. To the east, the Black Hills NF is comprised largely of ponderosa pine habitats, thus focusing on a different set of MIS as compared to the Bighorn. The Medicine Bow NF to the south is similarly revising its Forest Plan and is in the process of revising its MIS list. Some of the Medicine Bow habitats are similar to those found on the Bighorn. However, the two Forests are biogeographically isolated, separated by shortgrass plains, and resource management issues differ to some extent. Finally, the Thunder Basin National Grassland Plan was recently revised, but it considers Northern Great Plains habitats and species.

4) Principle 4 – *Consider whether employing MIS is the best approach to evaluate the management problem.*

Regulations require the use of MIS in forest planning and Plan implementation. However MIS are not meant to address all issues related to managing

biodiversity. The Committee of Scientists report (USDA 1999)² recommended the use of “focal” species in forest planning to expand the categories of species used for assessing viability of species. These recommendations have not been incorporated into the planning regulations, but should be considered as current science. In light of these considerations, many of the issues on the Bighorn are more adequately addressed through direct habitat measurements. As documented in the in the 2001 MIS review, these issues include: distribution and extent of old growth forests; availability of coarse woody debris and snags; aspen distribution and extent; quality and extent of riparian areas; cave system functionality; expanse of non-native plants (weeds and diseases); distribution of structural stages and landscape mosaics; and health of alpine meadows. Additionally, the presence or absence and/or distribution of rare species is often not an indicator of habitat condition, but instead a consequence of other factors affecting the species. For these species, a monitoring approach that seeks to answer these species-specific questions rather than forest-wide monitoring as an MIS would be more valid. However, it is also recognized that our knowledge of ecosystems is inadequate, and that monitoring only habitats or only for presence or absence of species is also not desirable as trends may be missed in focal species that provide some management indications or should trigger responses.

5) Principle 5 -- Choose an adequate but limited number of species.

The Bighorn NF, like all other Forests, must balance the potential benefits of monitoring any particular species with the cost in time and funds necessary to adequately implement the monitoring work. The Forest will continue to gather information on species other than those designated as MIS. The Forest is also a relatively small Forest, with a more limited amount of commodity outputs as compared to other Forests in the region, and more limited public use. These elements affect the Forest’s budget available for monitoring, and should also be considered in developing monitoring approaches that may have been developed for larger Forests, including the number of MIS species. The monitoring and evaluation section of the revised plan needs a balanced and well designed approach to providing monitoring that is meaningful to track viability elements and MIS requirements or intents.

SEVEN SELECTION STEPS

1. Assemble Information About the Forest and Species-habitat Relationships

Information assembled for consideration of MIS included habitat or ecosystem related reports, and lists of species occurring on the Forest. Habitat information included the forest-wide and geographic area existing condition assessments prepared for the **Analysis of the Management Situation** (AMS) portion of the revised plan, the Terrestrial and Aquatic Ecosystem Assessments (Regan et al 2003³; Winters et al

² USDA Forest Service. 1999. Sustaining the people’s lands: recommendations for stewardship of the National Forests and Grasslands into the next century. Committee of Scientists; USDA, Washington, D.C. p. 22.

³ Regan, C. et al. 2003. Terrestrial Ecosystem Assessment of the Bighorn Landscape. USDA Forest Service. Lakewood, CO.

2003⁴) prepared by the regional species viability assessment team, and the Historic Range of Variability report prepared for upland vegetation by the University of Wyoming (Knight and Meyer, 2002⁵). These documents also discuss past uses or impacts that may have shaped the condition or design of current habitat components. The desired condition for the Forest will be defined for the preferred alternative used to write the draft plan. The desired condition will be described by geographic area (9 total on Forest) through the compilation of management prescriptions in the area, and the area's unique attributes. The unique features were largely defined in the geographic area assessments conducted for the Analysis of the Management Situation. Known deficiencies either in information (e.g. extent of old growth) or in habitat conditions (e.g. riparian areas) have been identified as issues, and will be focused upon during implementation of the plan.

The list of dominant species and biotic communities were generated through the compilation of species lists in the **Emphasis Species Categories** document, the Forest's 2001 MIS review, aquatic and terrestrial species and habitats mentioned in the Aquatic and Terrestrial Ecosystem Assessments, and through general vegetation communities as described in the existing condition assessments in the AMS. Where possible, the integration of potential "focal" species with the selection of MIS was sought, as this concept was recommended by the Committee of Scientists Report (USDA 1999) as one area to improve or modify the MIS concept. A more narrow approach to the potential pool of species was necessary to reflect the ecological stressors related to resource management (i.e. commodity outputs and main uses or developments of the Forest), and the need for information that may be used in future revisions of the plan. Species with more narrow habitat associations were sought, and those that would be more indicative of local (Forest level) changes in habitat while having minimal influences from factors other than resource management.

2. Establish MIS Monitoring Priorities

The development of monitoring priorities was an interdisciplinary team function considering all resources and uses on the Forest, their risk from management activities, and with consideration of budget constraints. Primarily, monitoring was designed to provide an indication of how well the Forest was meeting the goals, objectives, and strategies identified in the revised plan. As MIS are both a required and desired component of the plan, the use of the major management issues and challenges listed in Principle 1 were considered in selecting MIS for monitoring and analysis purposes. Riparian values and habitat changes as they related to management activities, primarily livestock grazing and recreation use, were deemed of highest importance due to the potential effect on water quality and riparian dependent species. Forested and non-forested habitat values (timber harvest, prescribed burning, livestock grazing, road construction) were deemed of second priority due to their potential effect on wildlife

⁴ Winters, D. et al. 2003. Aquatic Ecosystem Assessment of the Bighorn Landscape. USDA Forest Service. Lakewood, CO.

⁵ Knight, D., and C. Meyers. 2003. Historic Range of Variability of the Forested Resources on the Bighorn National Forest. University of Wyoming. Laramie, WY.

habitat. These priorities were also confirmed by the social assessment conducted for the Forest (Blevins and Jensen 2002)⁶.

3. Identify Potential MIS Based on Categories Identified in the Regulations and the Forest Service Manual

The 1982 NFMA regulations at 36 CFR 219.19 identify five categories of species from which MIS may be chosen. The five categories are listed below, with the corresponding species that may be considered. It is not necessary to have a species reflected for each category. Plants, animals, communities, or special habitats, were considered as potential MIS. Species were not duplicated if they could be considered in multiple categories.

a) Federally and state listed endangered and threatened plant and animal species that occur in the planning area. As Wyoming has no state threatened or endangered species, only those federally listed or proposed through the Endangered Species Act were considered. The Forest received a species list dated February 22, 2002 from the U.S. Fish and Wildlife Service for consideration in all planning efforts, and included threatened (T), endangered (E), candidate (C) and proposed (P) species. These species are listed in Table 1 with a synopsis of their potential to function as MIS based on habitat, occurrence, and representation. For state listed species of concern, refer to the **Species Emphasis Categories** document. Additional documentation for TE species will occur in the Biological Assessment prepared for the DEIS, and in the Species Assessments.

Table 1. Federally Listed Species Considered on the Bighorn NF

Species	Habitat Description/Species Distribution
Bald eagle (T)	This species occurs migrationally (winter) on the Forest, feeding opportunistically on carrion or small mammals. There is no nesting or habitually used winter roosting habitat on the Forest (e.g. cottonwood riparian). There are no specific habitat associations known on the Forest. Monitoring by the WGFD occurs for any nesting pairs in the state. Historic nesting is not known to have occurred on the Forest.
Canada lynx (T)	This species occurred historically on the Forest, and recent sightings may indicate its continued presence. The Forest may or may not have provided a self-sustaining population of lynx. Current monitoring through presence/absence surveys has not shown any lynx to occur. Monitoring of occurrence through snow track surveys would likely continue, and habitat components including denning (old growth conifer) and foraging (young conifer) would be provided and monitored through other means. Lynx are capable of exploiting a variety of habitats, and thus may not be as narrowly associated to a habitat as desirable for an MIS.
Mountain plover (P)	The Forest has not been known to historically provide habitat for this species, nor have any observations of the birds been recorded to date. As this was a “new” inclusion on the list that the Forest needs to consider, surveys in potential habitat in 2002 and 2003 were conducted to indicate its presence or absence. Surveys conducted did not detect any plovers or potential habitat on the Forest. As habitat often used is shortgrass prairie, often in association with prairie dog towns, there

⁶ Blevins, A. and K. Jensen. 2002. Social Assessment of the Communities Surrounding the Bighorn National Forest. University of Wyoming. Laramie, WY.

	is none of this habitat available (historically or currently) on the Forest. Meadows exist where shorter grass occurs through grazing practices, though not of the same species composition, and often covered with snow through a significant portion of the bird's breeding season.
Ute Ladies'-tresses (T)	This species was also newly added to the list the Forest should consider in 2002. There is a very limited amount of potential habitat (low elevation relative to surrounding topography riparian, with cottonwood and/or low gradient elements, typically early seral, and found only on the plains in WY), which was surveyed in 2002 and 2003 to indicate presence or absence. No potential habitat was found, and no plants were found in these areas identified. It is not clear what this species would be an indicator of, though perhaps early seral riparian conditions. Botanists familiar with the species in WY have been contacted and were doubtful of its presence on the Bighorn National Forest due to lack of suitable habitat (Fertig, 2002).

- b) Consider species with special habitat needs that may be influenced significantly by planned management programs.** There are several species with narrow habitat associations (needs) that could potentially be affected by management programs, either in terms of the amount of treatment or the lack of it. Species identified with narrow habitat associations from the 2001 MIS review based on literature reviews included the following species listed in Table 2. Additional species that have known narrow habitat associations considered under this category are also listed in Table 2. There were no plant species considered under this category.

Table 2. Species with Special Habitat Needs Influenced by Management on the Bighorn NF

Species	Habitat Description/Species Distribution
Mammals	
Pine marten	Old growth and mature conifer, particularly spruce-fir with coarse woody debris. Known to occur in many areas of Forest.
Red-backed vole	Old growth and mature conifer, particularly spruce-fir. Widespread occurrence on Forest.
Red squirrel	Mature conifer and coarse woody debris. Very common throughout Forest.
7 Bat species	Primarily associated with caves and mines. Limited distribution on Forest. Many are FS sensitive species.
Water vole	Montane riparian above 7,500'. Limited distribution on Forest.
Birds	
Lark sparrow	Grassland and sage/steppe. Known to occur in many areas on Forest.
White-crowned sparrow	Montane riparian and krummholz zone. Widespread occurrence on Forest.
Three-toed woodpecker	Old growth and mature conifer, particularly spruce-fir. Known to occur in several areas of Forest.
Red-breasted nuthatch	Old growth and mature conifer with snags. Widespread occurrence on Forest.
Baird's sparrow	Montane riparian. Known in several areas of Forest.
MacGillivray's	Montane riparian. Known in several areas of Forest.

warbler	
Brown creeper	Mature and old growth conifer. Known in several areas of Forest.
Ruby-crowned kinglet	Mature conifer. Common throughout Forest.
Golden-crowned kinglet	Old growth and mature conifer, particularly spruce-fir. Known to occur in several areas of Forest.
Sage sparrow	Sage/steppe. Unclear if this species is breeding on the Forest, though likely in lower elevations around Forest.
Brewer's sparrow	Sage/steppe. Widespread where habitat occurs on Forest.
Aquatic	
3 amphibian species	Montane riparian/wetland. Very limited distribution on Forest.
Macroinvertebrates	Montane riparian/wetland. Widespread on Forest, depending on species.
Yellowstone cutthroat trout	Montane riparian/riverine. Very limited distribution on Forest.
Mountain sucker	Montane riparian/riverine. Very limited distribution on Forest.

- c) **Consider species that are commonly hunted, fished, or trapped.** These species were listed as Demand species under the **Emphasis Species Categories** document. In general, species in this category serve as poor MIS as their population trends are not related to management activities, but rather to consumptive harvest. Furthermore, with the exception of aquatic species, they are often generalists in terms of habitat. The 1985 Forest Plan used elk and deer as MIS, though only elk were recommended to be retained following the 2001 MIS review. Table 3 lists the demand species considered.

Table 3. Species commonly hunted, fished, trapped, or collected on the Bighorn NF.

Species	Habitat Description/Species Distribution
Mammals	
Elk	Mature conifer as cover, meadows as prime foraging sites. Forest-wide occurrence.
Moose*	Mostly riparian sites for foraging, cover sought in surrounding mature conifer. Forest-wide occurrence.
Deer	Mature conifer and shrub communities as cover. Foraging in meadows and shrub sites. Forest-wide occurrence.
Black bear	Mature conifer and rock outcrops as cover, foraging in shrub communities and riparian sites. Forest-wide occurrence, though elusive.
Mountain lion	Rock outcrops and shrub communities and mature conifer following big game. Forest-wide occurrence, though elusive.
Birds	
Ruffed grouse	Shrub and aspen communities. Primarily in the Tongue watershed and northern portion of the Forest..
Blue grouse	High elevation conifer, meadows, and montane riparian. Widespread occurrence on Forest.
Plains sharp-tail grouse	Meadows and shrub communities. Primarily occurs on the southeast portion of the Forest.
Gray partridge*	Grassland and low elevation shrub communities. Primarily on the west side of the Forest along face of mountains.

Wild turkey*	Ponderosa pine, lodgepole pine, meadows. Primarily on the southeast corner of the Forest.
Aquatic	
Brown trout*	Riparian. Limited distribution on Forest.
Brook trout*	Riparian and higher elevation lakes. Widespread on Forest.
Rainbow trout*	Riparian and lakes. Widespread distribution on Forest.
Snake River cutthroat trout*	Riparian and high elevation lakes. Mainly on west side of Forest, in limited areas.
Plants	
Sweetgrass	Meadows and moist sites. Somewhat limited distribution on Forest.
Purple coneflower	Dry sites – prairies. Unknown distribution on Forest.

* = Desirable non-native species

Elk and deer are generalists in terms of habitat used. The exception would be the relationship between elk security areas on the Forest and hunter harvest, where habitat conditions on the Forest (road density, cover elements) affects the level or type of harvest obtainable (Jellison 1997)⁷. This relationship can affect the economies of surrounding communities, since higher harvest levels on the Forest equate to increased spending by hunters in the surrounding communities. Past analysis has shown that elk populations in the Big Horn Mountain area are not as limited by Bighorn NF habitat conditions as they are by harvest levels, winter range conditions, and availability of private land “refuges” where hunting is not allowed. Summer habitat conditions, primarily forage quality and stress levels, do have a significant affect on winter survival of elk (Thomas and Toweill 1982)⁸. Elk may serve a purpose of indicating the level of road density that could potentially affect other species, and preferred security areas are often skewed towards mature conifer or old growth conditions due to the cover afforded (Sawyer 1997; Jellison 1997).^{9 10} However the effects of roads on species differ significantly among taxa. Cover elements may be altered either through management actions (prescribed burning, timber harvest) or through natural processes (fire, insect and disease). The larger blocks of cover used in defining security areas also provide an indication of the intactness or level of fragmentation of the forested stands. Security areas may also be quantifiable in effects analysis for the planning alternatives, and fulfill this aspect of the purpose for MIS. Refer to the Species Assessment prepared for elk for further information.

Other Demand species identified in the Species Emphasis Categories document include sport fish (rainbow, brown, brook trout, Snake River cutthroat trout), sweetgrass, moose, mountain lion, black bear, blue grouse, ruffed grouse, sharp-tailed grouse, gray partridge, and wild turkey. Populations of trout, moose, mountain lions, and black bears are strongly influenced by consumptive harvest

⁷ Jellison, B. 1997. Evaluating elk security areas in the Bighorn Mountains. Draft report prepared by the Wyoming Game and Fish Department. Sheridan, WY.

⁸ Thomas, J.W., and D.E. Toweill. 1982. Elk of North America - Ecology and Management. Wildlife Management Institute. Stackpole Books. Harrisburg, PA. p. 227

⁹ Sawyer, H. H. 1997. Evaluation of a summer elk model and sexual segregation of elk in the Bighorn Mountains, Wyoming. Master’s thesis. University of Wyoming. Laramie, WY.

¹⁰ Jellison, B. 1997. Elk habitat effectiveness on the Bighorn Mountains. Draft report prepared by the Wyoming Game and Fish Department. Sheridan, WY.

and climatic factors. The aquatic species are primarily monitored through periodic electro-shocking by the WGFD and USFS, and are tied to narrow habitat associations. Each of the terrestrial species is monitored by the WGFD through hunter harvest, or aerial and ground surveys, or other types of monitoring.

With rainbow trout being largely forest-wide in occurrence, and sensitive to changes in habitat conditions, this species could be a suitable MIS. Several reviewing parties indicated that aquatic indicators would also be desirable to include in the revised plan, for which this species would be suitable.

Moose are strongly associated with willow habitat and spruce-fir, and often drive the composition of the habitat rather than being affected by it. Numbers of moose are also difficult to determine through common survey methods. Mountain lions and bears are generalist species, though specific habitat elements are necessary that could be influenced by management. Due to their elusiveness, surveys for these species are difficult. Blue grouse are associated with mature conifer and meadows at high elevations, plains sharp-tailed grouse with grassland and shrubs, gray partridge with grass/shrub communities, and ruffed grouse with shrub communities, however all populations are strongly affected by climate factors, and somewhat by harvest. Wild turkeys typically inhabit the ponderosa pine forests on the fringe of the Forest on the southeast and east side, preferring mature conditions. Populations of turkeys are not forest-wide and are also strongly affected by climate and harvest. Sweetgrass is a plant used commonly by Native Americans, though is still relatively common on the Forest. Purple coneflower (Echinacea) has not been found yet on the Forest, though interest in this species for medicinal purposes indicates a concern for its abundance.

d) Consider non-game species of special interest.

Non-game species of special interest were considered in the **Species Emphasis Categories** document, including Forest Service Sensitive species and Species of Local Concern. Where species were mentioned in previous categories, they were not repeated below. Some sensitive species are also game species (sage grouse) but were only listed under this category. Species listed below that were not selected as an Emphasis species include the snowshoe hare and the pika, as they are Bighorn endemics.

Table 4. Non-game Species of Special Interest

Species	Habitat Description/Species Distribution
Mammals	
Bighorn sheep	Historically abundant, one small population remaining on Forest. Occupies low elevation grass/sage winter range, alpine cliffs and meadows in summer.
Pika	Known to occur on Forest in a likely genetically distinct and isolated population . Inhabits boulder fields at high elevations, foraging in adjacent alpine meadows.
Snowshoe hare	Known to occur on the Forest as a genetically distinct or isolated population, and provides prey for many predators, and is a game species. Occupies higher elevation spruce-fir, lodgepole, and riparian habitats. Other Forests in region considering using as MIS.
Wolverine	May sporadically occur on the Forest, though a self-sustaining population may

	not occur. Alpine, and mature to old growth conifer are their likely habitats.
Birds	
Harlequin duck	Montane riparian. Known to historically occur in a few areas of the Forest.
Boreal owl	Likely breeds on Forest, though limited observations. Primarily mature and old growth conifer.
Flammulated owl	May occur on Forest. No current observations known. Primarily mature and old growth conifer and aspen.
Great gray owl	Likely occurs on Forest, possibly not as breeder. Primarily mature and old growth conifer.
Short eared owl	Possibly breeds on Forest, though only one observation known. Grassland and sage areas are primary habitat.
Northern harrier	Grassland and shrub/steppe. Known in several areas of Forest.
Sage grouse	Sage/steppe. Leks and early brood-rearing areas can serve as adequate monitoring sites for MIS. Neither of these habitats occurs on the Forest, and birds only use Forest as late summer brood rearing habitat.
Lewis' woodpecker	Likely breeds on forest at lower elevations in ponderosa pine. Tied strongly to fire occurrence.
Northern goshawk	Known to occur on Forest. More of a generalist using mature and old growth conifer and aspen.
Swainson's hawk	Known to occur on the Forest in grassland and riparian habitats.
Peregrine falcon	Historically nested, and possibly three nesting areas are still used on the Forest (Goose, Shell, Tensleep). Steep canyon walls adjacent to riparian areas are primary habitat.
Merlin	Known to occur on the Forest, primarily in ponderosa pine or lower elevation conifer habitats.
Golden eagle	Known to nest on the Forest, using cliffs primarily near riparian areas.
Pygmy nuthatch	Known to occur on the Forest. Primarily mature and old growth conifer habitat.
Olive-sided flycatcher	Mature conifer with snags near grasslands. Known to occur in many areas of the Forest.
American dipper	Known to occur and breed on the Forest. Riparian dependent, primarily larger stream systems with boulder component.
Common loon	Known from a few occurrences on the Forest, low likelihood of breeding. Occupies small lakes, wetlands, riparian.
Willow flycatcher	Known from a few occurrences on the Forest. Occupies riparian habitat dominated by willows.
Loggerhead shrike	Grassland/shrub steppe. Known to occur in a few areas of the Forest.
Grasshopper sparrow	Grassland. Known to occur in several areas of the Forest.
Rufous hummingbird	Meadow/Riparian and conifer near riparian. Known occurrences.
Calliope hummingbird	Conifer near riparian zones. One known occurrence on Forest, likely elevation limited.
Plants	
Pink agoseris	Known to occur, occupying riparian habitats.
Northern arnica	Known to occur, occupying sedimentary Doug-fir and limber pine stands, and granite boulder fields.
Soft aster	Known to occur in upland grass and sagebrush habitats.

Upward lobe moonwort	Known to occur in one riparian area on the Bighorn NF.
Hall's fescue	Not likely to occur on Forest. Historical occurrence may have been off Forest. Montane upland meadows habitat.
Cary beardtongue	Known on Forest from disturbed sites on sedimentary soils in upland grassland/sagebrush habitats.
Northern blackberry	Known from one occurrence on Forest in a riparian habitat.
Hapeman's sullivania	Known to occur in wet limestone canyons.
Crenulate moonwort	2001 survey of the "known site" found Upward lobe moonwort but not Crenulate moonwort – possible misidentification previously, or plants just not evident in 2001.
Fragile rockbrake	Known to occur from one moist wooded slope on limestone cliffs.
Williams spring-parsley	Known from one vague historical reference on sedimentary soil in SE corner of Forest, on sagebrush ridge, not found in recent surveys on Bighorn NF. Known to occur near forest.
Large yellow lady's slipper	Known from two occurrences on Forest in decaying leaf litter in wooded areas.
Mountain ladies'slipper	Known from 3 locales on Forest primarily in ponderosa pine communities in canyon bottoms.
Russet cottongrass	Known from 1 occurrence on Forest swamps and bogs.
Grass of parnassus	Known from 1 occurrence on Forest in moist seeps.
Woodland horsetail	Known to occur in one riparian site on the Forest.
Sheathed musineon	Known from limestone outcrops and chugwater formation redbeds.
Mountain lousewort	Alpine meadows or alpine/subalpine talus or scree slopes.
Woolly twinpod	Known from three occurrences in roadcuts in a redbed shale, in lime-sandstone outcrops.
Tranquil goldenweed	Known from 3 locations on Forest in sagebrush/grasslands.
Lesser bladderpod	Known from 1 occurrence in wetland habitat.
Musk root	Known from 2 occurrences in cliff habitat.
Aromatic pussytoes	Known from 1 occurrence on ridges/talus.
Pygmy pussytoes	Known from 1 occurrence on open slope and ridge in alpine.
Lance-leaved grapefern	Known from 1 location in riparian area.
Mingan moonwort	Known from 2 locations in wide variety of habitats.
Rattlesnake fern	Known from 1 occurrence in shady site.
Mud sedge	Known from 1 occurrence in wetlands.
Short-leaved sedge	Known from 1 occurrence in alpine meadow/riparian.
Leafy thistle	Known from 1 location in moist soils along road.
White arctic whitlow-grass	Known from 2 locations in wilderness in talus slopes.

Howard forget – me - not	Known from 1 location in limestone outcrop.
Low fleabane	Known from 1 location in wilderness in cliff microsite.
Three flower rush	Known from 1 location in wilderness in riparian.
Watson’s prickly phlox	Known from 1 occurrence on sedimentary cliff.
Northern twayblade	Known from 2 locations in spruce forests.
Broad-leaved twayblade	Known from 2 locations in spruce forests.
Alpine poppy	Known from 1 alpine meadow
Large-leaved pondweed	Known from 1 location in stream.
Hairy Prince’s Plume	Limber pine woodlands, juniper shrublands on limey-sandstone ridges, dry dolomite cliffs/talus.

e) Consider additional plant or animal species whose population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality.

Within this category, the Forest identified beaver in the 2001 MIS review. Beaver would also fall under categories 2 and 3 described above. Beaver affect the availability of habitat for a variety of aquatic and terrestrial species, and also affect water quality and quantity available in a watershed. Beaver also require suitable habitat in riparian areas (adequate forage and dam building material), which can be directly affected by management activities including grazing (both domestic and wild ungulate) management, recreation management, forest management (to a lesser degree), and road maintenance and management. Beaver are trapped on the Forest, although at relatively low levels, and the WGFD has the ability to restrict trapping from areas where beaver are being re-colonized. Beaver are known to be present in much less abundance than was historically likely. Though they are not at risk from a viability perspective, their absence on the landscape has profound effects on riparian habitat quality. Refer to the **Species Assessment** prepared for beaver for further information.

During the 2002 MIS amendment process, the Forest was encouraged by the public to consider soil invertebrates. These animals indicate the relative condition or type of the soil, and are usually associated with varying accumulations of litter. However, the patterns expected under particular changes in vegetation conditions (e.g. fires, etc.) are not well understood, and no inventory of these animals has occurred to date.

Aspen and willow species are important habitat and diversity components on the Bighorn NF. Aspen is suspected to be declining in physiological condition and population structure in response to potential long term climate drying and increased temperature conditions, but is also directly affected by wildlife and livestock browsing, and by succession to conifer in many areas. Yearly regeneration treatments occur for this type of community, though few acres are accomplished due to cost and fencing required. As for willow species, yearly inventories are being conducted which apply the Bighorn Riparian Classification to riparian areas, including information on riparian seral stage and potential plant

communities. This inventory has been applied for approximately 5 years on the Bighorn in an effort to increase the knowledge and distribution of riparian communities. Several different willow communities have been identified as a result. Livestock and wildlife browsing influence species composition and structure, as well as disturbance events such as flooding or drought. Recreational use can trample plants, and water flows for maintenance are dependant upon beaver’s presence or absence, and forest density and condition.

4. Sort the Potential MIS Identified in Step 3, Grouped by Each Important Monitoring Priority Identified in Step 2.

The two monitoring priorities identified in Step 2 included riparian areas and forested/non-forested habitat diversity. Five criteria, summarized below, were identified in Hayward et al (2001) to apply to the evaluation of potential MIS at this step. Similar criteria were used in the 2001 MIS Review.

1. Scientific literature should support the assumed limiting factors and habitat associations. Where not included in the table below, documentation for assumptions is also contained in the 2001 MIS Review, Species Assessments, and/or Biological Assessment/Evaluation.
2. Favor species whose population trends can be monitored effectively and efficiently using established or accepted survey protocols at geographic and temporal scales that are commensurate with management objectives.
3. Population trends are more likely to reflect changes in habitat when a substantial portion of a species' life history occurs on the Forest.
4. In general, when choosing among a group of potential MIS, favor indigenous species.
5. MIS should reflect habitat change at appropriate spatial and temporal scales (forest vs. state or region or eco-province). Because of the importance of scale, monitoring should target species that respond to changes that reflect the scale of the management questions leading to the choice of particular MIS.

The complete list of potential MIS is displayed in the table below with corresponding rationale for why the species was or was not selected. This table compiles the species listed in Step 3, and total over 100 species. In addition to the five criteria, the factors of the guiding principles were also inherently considered in the evaluation of potential MIS. **Many species not selected as MIS would have monitoring applicable to the species and/or their habitat from a viability perspective. Upon completion, refer to the monitoring plan in the Draft Plan for these additional measures.**

Table 5. Evaluation of Potential MIS

Species	Rationale
CATEGORY 1 – FEDERALLY LISTED SPECIES	
Bald eagle	Not selected. Inadequate habitat associations on Forest. No nesting or

	primary roosting habitat, and lack of occurrences make it difficult to monitor population trends on the Forest, as only migratory use occurs.
Canada lynx	Not selected. Inability to locate resident animals makes it too difficult to monitor population trends. May use many habitats.
Mountain plover	Not selected. Not likely to occur on the Forest as documented in field surveys conducted in 2002.
Ute Ladies'-tresses	Not selected. Not likely to occur on the Forest as documented in field surveys conducted in 2002.
CATEGORY 2 – SPECIES WITH SPECIAL HABITAT NEEDS INFLUENCED BY MANAGEMENT	
<i>Mammals</i>	
Bats (7 species)	Not selected. Almost all are cave dependent. Provides indication of suitable cave conditions and impacts from recreation use, however other factors also relate to abundance. This is not one of the two monitoring priorities for MIS, but monitoring for viability purposes would continue.
Pine marten	Not selected. Difficult to assess population trends at forest-wide scale for MIS. Provision of and monitoring for old growth is a more valid approach. This species could be added in the future once old growth is inventoried, but monitoring for viability purposes would continue.
Red-backed vole	Not selected. Though linked to CWD, is a forested generalist. Difficult to assess populations trends at forest-wide scale. Provision of and monitoring for old growth deemed a more effective approach.
Red squirrel	Selected. Though somewhat of generalist in mature conifer, it is also linked to CWD in these habitats, and is most abundant in forested riparian areas. Populations tend to fluctuate with cone crops. However, monitoring feasibility is strong, and species is also serves as a “focal” species, since it is prey for marten, lynx, goshawks, and many other predators. Selected in 2002 amendment as a MIS.
Water vole	Not selected. Too few occurrences and limited distribution on Forest to monitor for forest-wide population trends or forest-wide scale of monitoring riparian habitat issue. Monitoring for viability purposes would continue. Could potentially be added in future as MIS once better distribution information is collected, as it is well correlated to certain riparian types.
<i>Birds</i>	
Lark sparrow	Not selected. Migratory species. Though a narrower habitat association, it may exhibit mixed results to vegetation management practices. Does not meet monitoring priorities, and has not been evident enough in avian monitoring to date to establish forest-wide trends. Was selected in 2002 amendment as a MIS.
White-crowned sparrow	Not selected. Migratory species. Populations not strongly associated with factors related to monitoring priorities, due to climate primarily. Was selected in 2002 amendment as a MIS. Monitoring would continue to provide information on the species.
Three-toed woodpecker	Not selected. Occurs in low densities until fire or insects/disease alter habitat, causing an irruption. Resident species. Provision of and monitoring for old growth is a more valid approach, but this species should be considered to be added once an old growth inventory is completed and monitoring specific to this and other old growth avian species can be added. Was selected in 2002 amendment as a MIS. Inadequate representation in current avian monitoring.
Red-breasted nuthatch	Selected. Though somewhat of a mature conifer generalist, it is a year-round resident, and is tied to the availability of snags. Provision of and monitoring for old growth will provide additional information. Monitoring would continue

	through avian species point counts as described in the monitoring plan. Was selected in 2002 amendment as a MIS.
Baird's sparrow	Not selected. Migratory species. Affected by climate and other factors not strongly associated with monitoring priorities.
MacGillivray's warbler	Not selected. Migratory species. Affected by climate and other factors not strongly associated with monitoring priorities.
Brown creeper	Not selected. Occurs in low densities. More directly associated with old growth, which would be provided for and monitored directly. This species could be considered for addition in the future, similar to three-toed woodpeckers, though its elusiveness makes it more difficult to detect than the woodpecker.
Ruby-crowned kinglet	Not selected. Migratory species off the Forest in winter. More of a habitat generalist in mature conifer, and dependent on climate, and unlikely to respond to monitoring priorities.
Golden-crowned kinglet	Not selected. More directly associated with old growth, which would be provided for and monitored directly. This species could be considered for addition in the future, similar to three-toed woodpeckers, once old growth inventories are completed.
Sage sparrow	Not selected. Migratory species. Poor representation on Forest in existing monitoring. Unknown occurrence levels or distribution.
Brewer's sparrow	Selected. Migratory species, but would provide information pertaining to the management of sagebrush habitat diversity (non-forested), which are actively managed with prescribed fire and is representative of monitoring priorities. Adequately sampled in existing monitoring. May provide indication of suitability of habitat for sage grouse.
<i>Aquatic Species</i>	
Amphibians (3 species)	Not selected. Patchy occurrence is not representative of forest-wide scale. Climatic factors and non-native species likely affecting more than FS management practices. Monitoring would continue for viability purposes.
Macro-invertebrates	Not selected. Forest lacks an adequate baseline inventory. Sampling is expensive. Project specific data inventory may be used in the future, and when sufficient data is accumulated, representative stream reaches could be used to select this assemblage of species as a MIS in the future.
Yellowstone cutthroat trout	Not selected. Patchy occurrence is not representative of forest-wide scale. Non-natives may be influencing more than FS management activities. Monitoring would continue for viability purposes.
Mountain sucker	Not selected. Patchy occurrence is not representative of forest-wide scale. Monitoring would continue as described in monitoring plan.
CATEGORY 3 – SPECIES COMMONLY HUNTED, FISHED, TRAPPED, ETC.	
<i>Aquatic Species</i>	
Rainbow trout	Selected. Existing population monitoring by state and FS provides information, and species responds well to habitat changes influenced by management activities. Though introduced, it is well distributed across the Forest, and meets the monitoring priority. There may be some expansion in existing monitoring, and refinements in representative habitat reaches to identify non-stocked populations to be used for monitoring. Challenges are influence by climate and fishing harvest. May be reduced in some areas to benefit YCT.
Brook, brown, Snake River cutthroat trout	Not selected. Existing monitoring by state and Forest provides information for projects and habitat. Populations influenced by climate and fishing harvest. Species and population monitoring would continue as described in the monitoring plan. Introduced species, with less common distribution than rainbow.

Mammals	
Elk	Selected. Relationship to management issues (vegetation management, road densities), modeled habitat, feasible to monitor population trends, possible indication of habitat for other species, forest-wide occurrence, forest-wide and project scale analysis, and tie of security habitat to old growth values all support selection. Challenges include the factor that populations are hunted, are affected by climate (drought and winter), may be less indicative of summer habitat conditions, and elk are capable of exploiting a variety of habitats. Past research provides information to support monitoring. Unknown if elk behavior will change if security habitat improved, however, due to use of private land currently for security habitat.
Deer	Not selected. Habitat generalist. No tie to issues or monitoring priorities.
Moose	Not selected. Though more specific in its habitat association, it is difficult to assess populations. Moose typically affect habitat conditions first, before being affected by habitat. Non-native species.
Mountain lion	Not selected. Difficult to determine population trends. No correlation to forest-wide issues or monitoring priorities. Hunted populations.
Black bear	Not selected. Difficult to determine population trends. Little correlation to forest-wide issues or monitoring priorities. Hunted populations.
Birds	
Blue grouse	Not selected. Difficult to determine population trends. No correlation to forest-wide issues or monitoring priorities, as somewhat of habitat generalist.
Ruffed grouse	Not selected. Difficult to determine population trends. No correlation to forest-wide issues or monitoring priorities. Limited distribution not useful for forest-wide scale.
Plains sharp-tailed grouse	Not selected. No correlation to forest-wide issues or monitoring priorities. Limited distribution not useful for forest-wide scale.
Wild turkey	Not selected. No correlation to forest-wide issues or monitoring priorities. Non-native. Limited distribution not useful for forest-wide scale.
Gray partridge	Not selected. Limited distribution not useful for forest-wide scale and no correlation to forest-wide issues or monitoring priorities.
Plants	
Sweetgrass	Not selected. Difficult to monitor trend on forest-wide basis with somewhat unknown distribution. No correlation to monitoring issues or priorities.
Purple coneflower	Not selected. Unknown distribution on Forest. No correlation to monitoring issues or priorities.
CATEGORY 4 – NON-GAME SPECIES OF SPECIAL INTEREST	
Mammals	
Bighorn sheep	Not selected. Inadequate representation of forest-wide issues and scale. Disease interaction with domestic sheep inhibiting current population, which may also come from lands adjacent to the Forest. Currently small population and poor distribution to indicate forest-wide trends.
Pika	Not selected. Infeasible to monitor at forest-wide scale, and does not represent forest-wide issues or monitoring priorities. Secure habitats with little likelihood of management disturbance in most of its range. Occasional recreation disturbance.
Snowshoe hare	Not selected. Uses multiple habitats. Cyclic populations may prevent linking to management related effects. Habitat not at risk of loss, and not linked to monitoring priority issues.
Wolverine	Not selected. Unknown occurrence and difficulty in detection makes it infeasible to monitor at forest-wide scale. Unclear tie to monitoring priorities.

Birds	
Harlequin duck	Not selected. Unknown occurrence and difficulty in detection makes it infeasible to monitor at forest-wide scale. Lacking tie to management related population effects.
Boreal owl	Not selected. Unknown occurrence and densities for baseline inventory. Though it has an adequate habitat association, it is difficult to monitor at forest-wide scale. Monitoring for viability purposes would continue.
Flammulated owl	Not selected. Migratory species. Unknown occurrence and densities for baseline inventory. May not be representative of forest-wide issues and scale.
Great gray owl	Not selected. Unknown occurrence and densities for baseline inventory. May not be representative of forest-wide issues and scale. Difficult to monitor at forest-wide scale.
Short-eared owl	Not selected. Unknown occurrence and densities for baseline inventory, and difficult to detect. Not representative of forest-wide monitoring priorities, issues and scale.
Lewis' woodpecker	Not selected. Limited distribution, and not representative of forest-wide monitoring priorities and scale.
Northern goshawk	Not selected. Limited distribution, and more of a habitat generalist. Difficult to monitor at forest-wide scale. Monitoring for viability purposes would continue.
Swainson's hawk	Not selected. Migratory species. Inadequate habitat association and not representative of forest-wide scale or priorities.
Peregrine falcon	Not selected. Inadequate distribution to reflect forest-wide scale. Not representative of monitoring priorities. Largely secure habitat.
Merlin	Not selected. Limited distribution, and difficult to monitor at the forest-wide scale.
Golden eagle	Not selected. Limited distribution. More of a habitat generalist, and not tied to monitoring priorities, issues, or scale. Nesting habitat is largely secure.
Pygmy nuthatch	Not selected. Limited distribution. Old growth habitat inventory and monitoring a more suitable approach at this time. This species could be added similar to three-toed woodpeckers in the future.
Olive-sided flycatcher	Not selected. Migratory species. Populations largely dependent on factors other than management. Existing monitoring would continue.
American dipper	Not selected. Unknown distribution and more limited in scale than forest-wide. Affected by other issues than management related actions.
Loggerhead shrike	Not selected. Unknown distribution and more limited in scale than forest-wide. Migratory species. Not representative of monitoring priorities.
Grasshopper sparrow	Not selected. Migratory species. Not representative of monitoring priority.
Rufous hummingbird	Not selected. Migratory species. Unknown distribution and difficulty in detection not useful for forest-wide scale. Unclear tie to monitoring priorities.
Calliope hummingbird	Not selected. Migratory species. Unknown occurrence and difficulty in detection not useful for forest-wide scale. Unclear tie to monitoring priorities.
Common loon	Not selected. Limited distribution and not representative of forest-wide scale or priorities. Migratory species.
Sage grouse	Not selected. Forest does not provide the majority of the species' habitat. Monitoring for viability purposes would continue.
Willow flycatcher	Not selected. Migratory species. Limited distribution for forest-wide scale.
Plants	
All plants listed in category 4 above.	Not selected. There is a lack of literature linking population trend to management activities for most of the species. All of the species have very limited distributions, indicating a lack of monitoring feasibility for forest-wide issues. Most of the plants do not have habitats that are indicative of monitoring priorities for MIS. Monitoring of each of these species would continue from a

	viability (species-at-risk) perspective, with any known management or habitat related issues addressed accordingly.
CATEGORY 5 - SPECIES WHOSE POPULATION CHANGES ARE BELIEVED TO INDICATE THE EFFECTS OF MANAGEMENT ACTIVITIES ON OTHER SPECIES OR ON WATER QUALITY.	
Beaver	Selected. Their documented importance in riparian system functioning, ability to provide habitat for other species, acceptable monitoring protocols (cache inventory from aerial or ground based methods) at forest and project scale, indigenous, resident, forest-wide status, and their need for adequate habitat (willows) in the presence of planned management actions (grazing, recreation use, road maintenance) all contribute to selection. ¹¹ Challenges will include a lack of populations compared to historic levels.
Aspen and Willow	Aspen and willow are more effectively monitored through direct tracking of habitat, rather than these communities' indirect ties to other species. Effects from climate related factors would make monitoring as MIS more difficult.
Soil Invertebrates	While providing indications on levels of litter or actual soil types, the Forest lacks a baseline inventory of these species. Not feasible to monitor population trends at the forest-wide scale.

5. Review preliminary list of MIS

In this step, the selected species are compared to the 3rd, 4th, and 5th guiding principles mentioned in Section 2 above. The 3rd principle involved considering MIS chosen on neighboring units. As stated previously, there are no neighboring units immediately adjacent to the Bighorn NF, and thus the 3rd principle was not considered through this process. The 4th principle involved answering whether or not MIS were the best way to evaluate the management problem. The scope of this principle lends itself to those problems that are common to the entire forest, and can be monitored and evaluated at both the forest scale and at the project scale. Many of the species considered did not occupy the entire forest or indicate a response to the issues or challenges inherent to management of the Forest. Many of the species were included due to elements of rarity, and thus made for poor choices as MIS. More commonly, the issues surrounding the potential species led themselves to direct monitoring of the habitat (aspen, willow, soil, old growth or riparian), rather than indirect monitoring of species associated with these types.

The 5th principle involved choosing an adequate but limited number of MIS. Perhaps some criticism could be applied to only choosing six MIS, however they are directly related to the monitoring priorities and issues and challenges identified in the 1st and 2nd principles. Having a limited number also increases the chance that the Forest will be able to accomplish the monitoring and desired habitat or population improvements under compressed budgets. Projects conducted during implementation of the forest plan commonly involve either forested and/or riparian communities, and thus the species will lend themselves to project level analysis. Improvements in habitat for MIS would also likely benefit a number of other species. With the state monitoring the populations of elk, this type of information is reliable and able to be readily assembled for monitoring. The beaver may present more challenges in obtaining population indices, although

¹¹ Olson, R. and W. Hubert. 1994. Beaver: Water resources and riparian habitat manager. University of Wyoming. Laramie, WY.

opportunities for coordination with the state also exist, and baseline information is being gathered in 2003. Existing avian monitoring would continue to establish baseline information for later trend analysis of the avian species and the red squirrel. Rainbow trout also have existing monitoring with the state and Forest, with few additional sites needed. Review of the monitoring plan as a whole proposed for the Forest demonstrates the inclusion of other habitats and species not covered through monitoring of MIS.

The specialists involved determined that the six species were adequate and effective in addressing the monitoring priorities and incorporated the intent of implementing MIS concepts, when viewed in association with the monitoring plan as a whole. There are species that can be added in the future pending additional baseline data acquisition. These include the old growth associated species (three-toed woodpecker, golden-crowned kinglet, brown creeper, marten) and aquatic macroinvertebrates.

6. Monitoring Protocols and Response to Change

For selected MIS species, it is necessary to consider both population and habitat monitoring. A description of the methods, scale, timing, thresholds of concern, and cost follows for each selected species.

EIk Elk populations are monitored annually by the WGFD, at the forest-wide scale (herd unit), with no cost to the Forest. Aerial observations are conducted in the winter, following hunter harvest. Results are published annually. With regard to scale issues, elk populations are managed according to objectives established at the herd unit and hunt area scales. There are two main herd units represented on the Forest, and a small portion of a third. Within each herd unit, several hunt areas are delineated through which population objectives are managed through different hunting techniques (e.g. season, sex, number). The Forest coordinates annually with the WGFD in terms of the populations and objectives. There is no cost to the Forest for obtaining this information.

Concerns on elk habitat are currently focused on elements of security areas, as the species is more of a generalist in terms of exploiting areas that are grass dominated for foraging, and more forested for cover aspects. Elk populations are currently not of concern, and both hunting and winter severity are the primary determinants on population levels. While vegetation management in the past has provided increased foraging habitat, the roads created have reduced security habitat that is important for population management. It is currently difficult for the WGFD to manage elk populations due to the elk seeking private land or other areas off the Forest where public access is not given. Abundant security habitat also provides increased hunting opportunities, which have a correlation to economic factors in the local communities. While populations would be used in a monitoring context, the potentially more important effect to monitor will be the changes in hunter opportunity gauged by the level of elk security habitat, and elk response to those areas. This will be done in conjunction with the WGFD, at both the forest scale and individual project implementation scale.

The Forest modeled elk security habitat using GIS analysis of vegetation and road attributes, and developed a management guideline for this type of habitat. This type of habitat can also be monitored through time and with individual projects using the same

approach, and can be used to display the effects of different plan alternatives considered. The description of this modeling process, and the guideline associated with it, and the scale for which it was intended, can be found in the draft plan. It is anticipated that this type of habitat analysis and monitoring would be of minimal to moderate cost, depending on the level of management or natural vegetation events in a given geographic area. There was extensive coordination with the WGFD regarding this issue. Elk have been the species of choice since the 1985 plan due to the level of public interest in the species, the research applied to the species, and the correlations to management practices (roads, harvesting) that have been developed. As concerns with road density were also a factor for elk habitat use outside of security areas, management guidelines were created to help address this issue. The 1985 plan used hiding cover for elk as the management guideline, and since then the HABCAP model, and an elk habitat effectiveness model have been used in some project level analysis to address more modern concerns of elk habitat requirements. These concerns were generated through continued coordination with WGFD since approximately 1990, when concerns over harvest levels and other effects led to the beginning of the ASQ amendment that the Forest prepared but did not complete. It is anticipated that another review or calibration of the elk security habitat model would occur with the next plan revision, or sooner if necessary. Areas that are not currently security habitat due to the young condition of trees may have grown sufficiently by the next revision to be considered.

A threshold of concern would be the further loss of more than 5% of existing security habitat in any given geographic area (9 watersheds on Forest). Reaching this threshold should instigate further analysis in conjunction with WGFD. The past thresholds identified in the 1985 plan of population levels would also be valid to continue, as changes of greater than 20% in herd composition or levels over a three year period may indicate the need for changed habitat management.

Summer habitat quality is also of importance to elk in determining winter survival as forage conditions can determine relative health prior to arrival on winter range. This factor is currently more confusing to monitor due to cumulative effects from other wild and domestic ungulates. Habitat concerns for summer foraging habitat are currently focused on meadows, riparian shrubs, and aspen.

Beaver Beaver populations are currently at lower levels than likely historically occurred. Trapping was extensive in much of the Rocky Mountain region during the European settlement era. Beginning in the 1930's and 1940's, the WGFD undertook an aggressive re-colonization program for beaver, of which the Bighorn was a part. Beaver currently do not occupy their entire potential habitat. It is interesting to note that beaver occupy non-typical habitat areas on the Bighorn, such as ponds surrounded by lodgepole pine in remote areas, rather than typical riparian corridors. This indicates that some level of mortality may be an issue for the species in more publicly used areas. This could be due to road management concern in some areas, trapping, or general public perception of the species, or possibly disease elements. Refer to the species assessment for further details.

Population estimates may best be obtained through aerial surveys of active caches in occupied drainages. This information will be sought in conjunction with the WGFD, and/or in conjunction with ground surveys by Forest personnel. While modeling of habitat is not an important issue, this also makes a display of effects from different plan

alternatives difficult to analyze. As the main determinant in riparian habitat quality for the species is associated with domestic and wild ungulate use of this habitat, and since the levels of this type of activity will not be altered by different alternatives, this may be acceptable. The importance and value of beaver are in the species' ability to create and maintain quality riparian habitat. If potential habitat cannot be provided in terms of forage and dam construction material, this would potentially be demonstrated through failed reintroductions. Beaver naturally move from one drainage to another, so this must also be considered in evaluating population levels or success of reintroductions. While this type of population monitoring may have greater costs associated with it, it was deemed to be practical given the importance of the species and the need for an MIS. Aerial surveys would take approximately one week to complete for the Forest, at a cost of approximately \$5,000, and could be done every 5 years to provide population trend information.

Occupied habitat and population estimates will be obtained in 2003, with results included in this section upon completion. It is estimated that repeating this type of information at five-year intervals would be suitable for tracking changes in population levels and associated habitat occupancy. In terms of a threshold, a loss of beaver occupancy in any 6th level Hydrologic Unit Code (HUC) watershed could be used to trigger a more in-depth analysis. Reintroduction efforts, mentioned as a management strategy in the revised plan, would be focused on those areas that have potential habitat and/or were historically occupied (presence of old beaver dams). It would be the desire to achieve reoccupation of all 6th level watersheds that show historic signs of occupation first, and expand from there.

Red squirrel

While red squirrels are currently widespread in the Forest, potential changes in forest structure from widespread disturbance agents, such as fire and insects and disease, and from timber harvest can provide variations in this species' population trends. Cone crops can also provide fluctuations. Currently, no baseline population information exists.

In 2002, the avian monitoring begun on the Forest, in conjunction with statewide monitoring will begin providing this information as red squirrel locations (through vocalizations and observations) are also recorded. This is currently an annual process, and the Forest's cost for this monitoring is approximately \$25,000, which includes both statewide and Forest specific monitoring. On the Forest, 4 habitat types were selected (sage/grass, high elevation conifer, mid elevation conifer, and riparian), and 10 point count monitoring transects randomly located in each of these habitat types. Within each transect, 15 point count stations, 250m apart, are conducted. These points will have digital photographs of the habitat represented in the next year or two, and currently are located with GPS units to provide repeated accuracy. For squirrels, both the high-elevation conifer and the mid-elevation conifer monitoring transects provide monitoring information. Trends of the species should be examined at 5 year intervals. There can be no correlation to statewide information, as the Bighorn is the only Forest currently obtaining information on red squirrels.

In terms of a threshold, a change in 20% in the population trend should trigger further analysis. This figure was developed as an estimate in the 2001 MIS review conducted on the Forest. A guideline was developed to allow an estimated proper amount of

habitat (mature conifer) for the species as well, to be measured at the forest-wide and project level scale.

Red-breasted nuthatch

Similar to the red squirrel, there is no baseline population information available. The same provisions for monitoring methods, cost, timeframes, and thresholds would apply for this species. This species is also represented by both the mid and high elevation conifer avian monitoring transects. Trends should similarly be examined at the five year period, with results correlated to the statewide information that will be available as a result of the "Monitoring Wyoming's Birds" program. This information would likely be used to reassess the Partners In Flight ranking protocol for species, applicable at the statewide and regional scale.

Brewer's sparrow

There are currently no Brewer's sparrow baseline population trends available. With the concern over sagebrush habitats associated with the sage grouse and other obligate species, monitoring for Brewer's sparrow would also provide an indication for these species. This species was added to the Region's sensitive list for this purpose. Avian monitoring as described above for the red squirrel and nuthatch provides information for the Brewer's sparrow. It is represented by 10 transects that occur in the sage/grass habitat type, where the Forest conducts frequent prescribed burning to obtain habitat diversity. As Brewer's sparrow represent sage obligates tied to a more dense canopy cover of sage brush, a decrease in trend could indicate that too much treatment had occurred, although other guidelines were developed to ensure all age classes of sagebrush occur. As stated for the nuthatch, population trends should be examined at 5 year intervals and correlated to statewide information available.

Rainbow trout

Currently, rainbow trout populations are estimated at stable levels, and are known to occupy many drainages on the Forest as described in the species assessment.

Monitoring is conducted annually in conjunction with the WGFD, with a target of sampling between 4 and 7 reaches within selected drainages on the Forest every year. In addition, basin plans exist for each drainage on the forest, which includes population estimates for all trout species. These are reviewed and updated every 5 years. Electrofishing techniques are used to sample in representative reaches. The Forest spends approximately \$3,000 per year to contribute to this effort. The present inventory scheme should be sufficient to monitor rainbow trout populations on the Forest.

At the end of a sampling regime, population trends can be compared to previous data. A threshold of a 20% reduction in the population trend would be used to cause further investigation and actions to reverse the trends if tied to management activities.

Additional monitoring for water and riparian quality habitat purposes was identified in the monitoring plan to provide ties to physical habitat parameters for this species.

In summary, it is estimated that approximately \$35,000 would be needed per year to conduct monitoring for MIS, averaging the higher costs in some years associated with some of the species. Monitoring for other habits and species in the monitoring plan would be in addition to this.

7. Review of the MIS Selection Process and Report

The Rocky Mountain Regional Office of the Forest Service conducted a review of this report, and included aquatic, botany, and wildlife specialists. In addition, comments were solicited from the Wyoming Game and Fish Department, Sheridan and Cody Regions, including non-game biologists. **List any comments from 2nd review here...**

Initially, the Forest proposed using only two species as MIS (elk and beaver) as it felt the monitoring it was conducting for other species and habitat purposes fulfilled the role associated with MIS. Upon further inspection and regional office comment, the six species chosen were selected to give a more broad based approach using the MIS concept, to include more focal species and issues, and to more adequately address concerns raised by the public in the previously limited species selection.