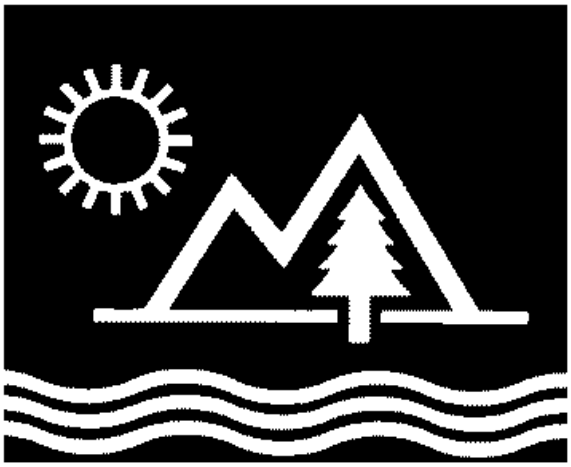
Expert Interview Summary

for the

Black Hills National Forest

Land and Resource Management Plan

Amendment



USDA Forest Service

Black Hills National Forest

Custer, South Dakota

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BACKGROUND

In 1997, the Black Hills National Forest (Forest) revised its Land and Resource Management Plan (Forest Plan; USDA Forest Service 1997). The decision for this was appealed, and was consequently reviewed by the Forest Service Washington Office (WO). The appeal decision affirmed most of the original decision, but it included instructions for further actions concerning the issues of species diversity and viability of sensitive species (USDA Forest Service 1999). The Forest was directed to re-evaluate the Forest Plan for its ability to meet diversity and viability requirements set in existing laws, and correct any deficiencies. Until those processes are completed, the WO provided additional protective measures for the Forest to apply (i.e., Interim Direction).

The Forest will complete the required evaluation and adjustments to the Forest Plan in two phases. Both phases will result in amendments to the Forest Plan. The Phase I Amendment is intended to address short-term concerns, while the Phase II Amendment will address long-term concerns.

INTRODUCTION

Forest biologists interviewed accredited scientific experts to obtain information on Region 2 sensitive species for use during the Phase I Amendment. The interview process is described in Appendix A. This document integrates and summarizes the data obtained during those interviews.

Interviews focused on Region 2 sensitive species that occur or potentially occur in the Black Hills, because these species were specifically mentioned in the WO appeal decision, and because they present the most risk for viability. Species were often grouped together to form logical interview topics. The groups and species are listed in Table 1.

Scientists were presented with two alternatives to consider in the interview. Alternative 1 was the Revised Forest Plan (USDA Forest Service 1997). Alternative 2 was the Revised Forest Plan supplemented by the interim direction provided in the Washington Office appeal decision (October 12, 1999). The intent was to gather as much information as possible about risks to sensitive species, and to get suggestions on strategies to address weaknesses in the Forest Plan and/or interim direction. In Phase I, Forest Service managers will use the information gathered in the interviews to devise strategies to assure management options for sensitive species are maintained, as well as the communities and processes that maintain them. This approach will help the Forest build a credible strategy for maintaining management options for sensitive species over the next five years, or until the Phase II Amendment is completed. The interviews were conducted prior to the formal NEPA process (Phase I) associated with amending the Forest Plan under NFMA. Management alternatives will be developed in the formal NEPA process.

Table 1. Groups and Species Discussed During Interviews

Plants

- *Adenocaulon bicolor* (American Trailplant)
- *Adiantum capillus-veneris* (Southern Maidenhair Fern)
- *Arnica lonchophylla* (Northern Arnica)
- *Botrychium campestre* (Prairie Moonwort)
- *Carex alopecoidea* (Fox Tail Sedge)
- *Carex intumescens* (Greater Bladder Sedge)
- *Carex pedunculata* (Long-stalk Sedge)
- *Corallorhiza odontorhiza* (Autumn Coralroot)
- *Epipactis gigantea* (Giant Helleborine)
- *Equisetum scirpoides* (Dwarf Scouring Rush)
- *Lycopodium complanatum* (Trailing Clubmoss)
- *Lycopodium dendroideum* (Treelike Clubmoss)
- *Muhlenbergia glomerata* (Marsh Muhly)
- *Platanthera orbiculata* (Large Roundleaf Orchid)
- *Salix serissima* (Autumn Willow)
- *Sanguinaria canadensis* (Bloodroot)
- *Scirpus cyperinus* (Woolrush)
- *Viola selkirkii* (Great-spurred Violet)

Mammals

- American Marten (*Martes americana*)

Bats

- Fringe-tailed Myotis (*Myotis thysanodes*)
- Townsend's Big-eared Bat (*Plecotus townsendii*)
- Spotted Bat (*Euderma maculatum)*

Other Mammals

- Dwarf Shrew (*Sorex nanus)*
- Swift Fox (*Vulpes velox)*

Birds

Northern Goshawk *(Accipiter gentilis)*

Woodpeckers

- Black-backed Woodpecker (*Picoides arcticus)*
- Northern Three-toed Woodpecker (*Picoides tridactylus)*
- Lewis's Woodpecker *(Melanerpes lewis)*

Other Birds

- Fox Sparrow (*Passerella iliaca*)
- Golden-crowned Kinglet (*Regulus calendula*)
- Loggerhead Shrike (*Lanius ludovicianus*)
- Merlin (*Falco columbarius*)
- Olive-sided Flycatcher (*Contopus borealis*)
- Osprey (*Pandion haliaetus*)
- Purple Martin (*Progne subis*)
- Pygmy Nuthatch (*Sitta pygmaea*)
- Upland Sandpiper (*Bartramia longicauda*)

Reptiles

- Black Hills Red-bellied Snake (*Storeria occipitomaculata pahasapae)*
- Milk Snake (*Lampropeltis triangulum)*

Amphibians

- Northern Leopard Frog (*Rana pipiens*)
- Tiger Salamander (*Ambystoma tigrinum*)

Butterflies

- Regal Fritillary (*Speyeria idalia*)
- Tawny Crescent (*Phyciodes batesii)*

Snails

- Cooper's Rocky Mountain Snail *(Oreohelix strigosa cooperi)*
- Striate Disc (*Discus shemiki*)

Objectives for the Phase I Expert Interview process were:

- To assess the current conditions for sensitive species.
- To assess the effects of the Forest Plan, including the additional protective measures, on species. Assessment was based on immediate effects (i.e., within five years) and longer-term implications of those effects.
- If the additional measures would have limited effectiveness in providing capability to support species, obtain information on factors causing such inadequacies and other measures that would be more effective.

The scientists were selected based on their species-specific expertise, or their expertise in population ecology. Two to five experts were interviewed for each species, and oftentimes, individuals were interviewed on more than one species. Most scientists were interviewed individually, but on two occasions, two were interviewed together. Dr. Reynolds and Dr. Boyce were interviewed together (goshawks) at their request. Dr. Raphael and Dr. Aubry were interviewed together (marten) because they are located in the same office. The experts are listed in Appendix B.

Written notes were recorded during all interviews (see project record). No audio or video recordings were made. Therefore, the quality of the original interview notes varies depending on such factors as complexity of discussions and the biological knowledge and typing skills of the recorder. To ensure an acceptable level of accuracy, the Forest provided each scientist with a copy of the draft notes for their review. All corrections provided by the scientists were incorporated in the final version of the notes.

Two of those interviewed were contacted after the interviews to help clarify the interview notes. Dave Ode and Hollis Marriott provided clarification on the plant interview notes to facilitate the writing of this document.

For more information on the interview process, see Appendix A.

DOCUMENT ORGANIZATION

This document contains two major sections and various subsections for each species or group of species presented in Table 1. The headings are tiered (i.e., indented) to show their relationship to other headings. An explanation of the type of information contained under each of the headings is provided below. Assumptions and limitations specific to each section are also provided. For the purpose of this Document Organization section, the headings are placed in parentheses to indicate explanation rather than results.

(INTERVIEW RESULTS)

This section contains paraphrases of what was actually stated during interviews. With the exception of minor inferences, it is not supplemented with information obtained outside of the interviews.

(Natural History)

Natural history information was obtained as a by-product of the interviews. Because this information was discussed during various parts of the interviews, it is not complete, and may sometimes appear disjointed. The Biological Assessment/Biological Evaluation (BA/BE) prepared for the Forest Plan EIS (USDA Forest Service 1996) provides an overview of natural history

and habitat relationships for all of the species discussed in this summary document. Refer to the Forest Plan BA/BE for additional natural history information.

(Current Condition)

The scientific experts provided an estimate of the current condition for each species. They described the current condition using either pre-defined outcome statements (Appendix A), or their own words.

(Effects of Proposed Activities)

In this section, the scientists evaluated effects of various management activities (e.g., timber harvest, grazing, etc.) on the species in question. When effects differed between Alternative 1 and Alternative 2, the scientists disclosed them separately. When the alternatives were not analyzed separately, it can be assumed there are few differences between the alternatives with respect to the species being discussed and that the effects are the same or very similar.

Each species has a different set of activities for which they were evaluated. This is because each species reacts differently to a given activity; what may affect one species may not affect another. The Forest presented all management activities to the scientists, and the scientists determined which activities to evaluate. If this document provides no information for a particular species-activity combination, the scientists did not identify it as a concern.

In many instances, the scientists discussed direction of effect, duration of effect, and overall level of management activity. For the correct context of these items, see Appendix A.

(Overall Effect of Management Activity)

In this section, the scientists estimated the overall effect of the two alternatives on the capability to support the species. The estimate was based on five years of implementation (i.e., the duration of the Phase I Amendment), but considered long-term implications of implementation (e.g., a certain volume of timber may be harvested in a five year period, but some of the effects will last longer). Experts were asked to select one of four pre-defined outcomes (Appendix A), or describe an outcome in their own words.

(INTERVIEW TEAM CONCLUSIONS)

This section displays the conclusions drawn by Forest personnel that conducted the interviews and summarized the information. A list of these personnel is in Appendix B. Results are summarized, and differences and uncertainties encountered during the interview are noted. Because the

scientists did not always portray consistent opinions, the conclusions presented here may not support the findings of all scientists.

(Phase I Recommendations)

In this section, the interview team lists recommendations for the Forest to consider during the Phase I Amendment process. The recommendations are based on suggestions made by the scientists, but because the scientists did not always portray consistent opinions, the recommendations are not always identical. The items are important in the short-term to ensure preservation of management options over the next five years.

(Phase II Recommendations)

In this section, the interview team lists recommendations for the Forest to consider during the Phase II Amendment process. The recommendations are based on suggestions made by the scientists, but because the scientists did not always portray consistent opinions, the recommendations are not always identical. Many of these recommendations are more complex than the Phase I recommendations, due to additional data requirements, complicated analyses, and/or differing opinions from the scientists.

(SURVEY AND MONITORING METHODS)

This section provides information on effective and/or efficient survey and monitoring techniques that were suggested by the scientists. It does not convey the importance or priority of monitoring a given species; this information is included in the Phase I and Phase II recommendations sections.

LIMITATIONS AND ASSUMPTIONS

This document is a summary of discussions about species or groups of species and how they are affected by management actions. The contents are based on the notes recorded during the interviews. This is not a complete synthesis of information or literature on the species addressed here. In addition, each section pertains only to the species or group of species for which it is presented. An attempt was made to reference between sections if contradicting information was obvious from the interviews.

The information provided to the experts and the judgments made by the experts assumed implementation of standards and guidelines for each alternative.

This document is not intended to replace the effects analysis in the NEPA process, although the information may be useful in completing or supporting the NEPA analysis. The interviews included discussions on effects of management activities. This was necessary in order to identify threats to species viability and possible weaknesses in the Forest Plan and/or Interim Direction.

Additional limitations and assumptions are provided in the Document Organization section above.

PLANTS

SPECIES:

- *Adenocaulon bicolor* (American Trailplant)
- *Adiantum capillus-veneris* (Southern Maidenhair Fern)
- *Arnica lonchophylla* (Northern Arnica)
- *Botrychium campestre* (Prairie Moonwort)
- *Carex alopecoidea* (Fox Tail Sedge)
- *Carex intumescens* (Greater Bladder Sedge)
- *Carex pedunculata* (Long-stalk Sedge)
- *Corallorhiza odontorhiza* (Autumn Coralroot)
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- *Muhlenbergia glomerata* (Marsh Muhly)
- *Platanthera orbiculata* (Large Roundleaf Orchid)
- *Salix serissima* (Autumn Willow)
- *Sanguinaria canadensis* (Bloodroot)
- *Scirpus cyperinus* (Woolrush)
- *Viola selkirkii* (Great-Spurred Violet)

EXPERTS:

- Hollis Marriott, Black Hills Community Ecologist, Association for Biodiversity Information, Laramie, Wyoming
- Dave Ode, South Dakota Natural Heritage Program, South Dakota Department of Game, Fish and Parks, Pierre, South Dakota

INTERVIEW RESULTS

In Ode's opinion, *Arnica lonchophylla, Adenocaulon bicolor, Carex pedunculata, Carex intumescens*, and *Lycopodium dendroideum* no longer merit recognition on

the Region 2 sensitive species list because survey efforts have shown robust populations in the Black Hills. For this reason, none of these species were discussed further during his interview.

Ode deferred to Marriott for *Carex alopecoidea* and *Botrychium campestre* and did not comment on these two species.

Natural History and Current Condition

The Black Hills Sensitive Plant Field Guide (Fertig 1993) should be used as a companion to the species information presented below.

Adiantum capillus-veneris* and *Epipactis gigantea

Ode noted that these two species have existed along Cascade Creek/Springs for 100 years, based on Bessey's observation in the late 1800s. To the best of Ode's knowledge, they have never occurred anywhere else except perhaps uppermost Hot Springs (Evan's Plunge area), which was disturbed even before European settlement. According to Ode, this far north, both species are tied to warm, calcareous waters, and these are disjunct populations from populations farther south and west, and populations in Canada. Ode felt this situation did not fit any of the outcome categories well, but is closest to Outcome D (suitable environments are highly isolated or they exist at very low abundance), although there has not been a significant reduction from the historical range.

Botrychium campestre

According to Marriott, this species is notoriously difficult to survey for, and is difficult to detect during a typical mid-season survey. Marriott could not address this species because so little is known about it since there are so few observations, and because of the lack of available knowledge regarding suitable habitats. It has been reported thus far to occur in pine forest. Marriott indicated this species has not been detected during surveys, so it is rare, but it is unknown how rare. Marriott also noted there are taxonomic questions regarding this species. Recent literature (Wagner and Wagner 1993) identifies new species, subspecies, and varieties. If additional specimens are found on the Black Hills, Marriott recommended an evaluation of taxonomy. Marriott also suggested that intensive surveys be done for this species or there may be big losses in the next five years.

Carex alopecoidea

Marriott stated that this plant is an emergent species. Not all specimens from the Black Hills perfectly fit the species as currently described, and more work is needed on this. Sometimes this species is a "best fit" compared with other choices. There is one location at Upper Sand Creek and another at Dugout Gulch; both are small populations. According to Marriott, this species appears to be very limited in distribution. The question is why this plant is not found all

along the drainages where it occurs. Marriott suggested that it is possible the populations move around depending on disturbance or some other factor.

Carex intumescens
Refer to the Black Hills Sensitive Plant Field Guide (Fertig 1993).

Corallorhiza odontorhiza
Ode indicated this is an eastern deciduous forest orchid that has been collected infrequently, and specific habitat needs of this species in the Black Hills are unknown. Because none of the coralroots occur in grasslands or meadows, Ode assumed this is a forest species that requires decaying woody plant material above or below ground. Marriott added that the mycorrhizal relationship is probably important, as in other coralroots, and some information may be available in the literature from other regions because they are disjuncts from populations elsewhere. In the Black Hills, it is not restricted to hardwood forests (Ode). According to Marriott, it has been reported in pine forest, although little is known about this species and suitable habitats because there are so few observations. Marriott also noted that this species is difficult to detect during typical mid-season surveys, and has not been detected during surveys so it is rare, but it is unknown how rare. According to Ode, monitoring plot studies of orchids in general show a lot of variability in above ground location over time. According to Ode, there is one verified observation in pine forest southeast of Deadwood (South Dakota Natural Heritage Program records), although the exact location cannot be determined from the existing record.

Equisetum scirpoides
The Black Hills is the only forest in Region 2 that has this species. There are ten to 15 known occurrences of this species in the Black Hills. Three sites are in botanical areas (Upper Sand Creek, Bear/Beaver Gulches, Higgins Gulch.) It typically occurs in cool, moist, shaded, streamside slopes and terraces, although one site is reported as a dry gulch that may be an old mining adit.[1] Half the occurrences are based on older herbarium records, which do not have very good habitat information.[1] Forest types include spruce forest and birch/hazelnut (Ode). The sites Marriott has seen are small populations associated with birch communities. Ode noted that there is likely gene flow among the Black Hills populations because the species has wind-dispersed spores. Ode stated this species appears to be deep-rooted, and can vegetatively reproduce. There is no long-term data, but the species has been present in Spearfish Canyon for 50-60 years; these are possibly long-lived colonies (Ode). Ode noted, however, that it is unknown whether the populations are still at the same sites. Ode stated that most riparian zones are very dynamic, so a colony may get scoured out, but it is assumed these colonies are persistent, like aspen. While it is unknown to what degree *E. scirpoides* tolerates disturbance, some *Equisetum* species are colonizers of disturbed areas, and given the dynamic habitat of *E. scirpoides*, one

[1] Clarification provided by Ode on 10/2/2000.

would assume that it is adapted to flooding and scouring (Ode).[1] This species is small and inconspicuous so is very difficult to detect during surveys; for this reason, it may be more common than is known (Ode).

Marriott felt the current condition for this species is close to either Outcome C (suitable environments are frequently distributed as patches or they exist at low abundance) or Outcome D (suitable environments are highly isolated or they exist at very low abundance). She suggested additional surveys be conducted for this species.

Lycopodium complanatum

According to Ode, this species was not known to occur in the Black Hills until the 1980s, and since then it has been found in only three or four locations. Ode was familiar with only one site, and was uncertain whether it is on Forest Service land or private land. Ownership of the other one or two sites (two distant colonies within Bear Gulch) is also unknown but appears to be private.[1] Marriott indicated that known populations are small, and may consist of just a few individual plants with multiple stems. The site at Sand Creek is on Forest Service land within the Sand Creek Botanical Area (Marriott).

According to Ode, this species occurs primarily in cool, shady, spruce or birch habitats. Marriott indicated steep, north-facing slopes provide suitable habitat. One known site is in a spruce/grouseberry community, another site is in birch/hazelnut (Marriott). Ode noted that the Strawberry Creek site in the Black Hills has shallow soils, in duff over rock.[1]

Marriott estimated Outcome E for the current condition of this species (suitable environments are highly isolated and they exist at very low abundance).

Muhlenbergia glomerata

There are approximately six known occurrences of this species in the Black Hills: two sites are in botanical areas (Bear/Beaver Gulch and McIntosh Fen); there is one site along upper Castle Creek; and there are several sites in Spearfish Canyon (which is protected). Ode indicated that there is currently conflicting information on this species and whether or not it should be considered a sensitive species. South Dakota does not track this species as an element species.[1] Ode related that this species is typically associated with fens, although in the Black Hills it has apparently been found on a number of sites not associated with fens. Ode stated that there are a couple of dry sites where plants have been found that are suspected to be this species, but it has not been verified. Ode also noted that if this species is occurring on dry sites, our perception of this species and its habitat requirements would change, as well as whether it should be considered a sensitive species. Due to this conflicting information, Ode was uncomfortable making assessments for this species, and it was not discussed further during his interview.

[1] Clarification provided by Ode on 10/2/2000.

Marriott concurred that there is some taxonomic confusion on this species, because *M. racemosa* is very similar. Several specimens collected from an upland site in 1999 are identified as *M. glomerata*. Marriott has surveyed areas in the Bearlodge Mountains specifically for this species and did not find it, although she collected it in the area during her graduate research survey. She recommended more research to answer taxonomic questions.

Platanthera orbiculata

Ode indicated this species appears restricted to birch-hazelnut or similar hardwood community, and is difficult to locate during surveys because of heavy shrub cover (Marriott). Other habitat requirements are unknown (Marriott). There is a lot of habitat that appears suitable but the plant is not present, and stochastic events may play a large role in distribution in the Black Hills (Marriott). There are approximately 15 populations of this species in the Black Hills, most of which contain less than ten plants. This species occurs inside botanical areas, in the Black Elk Wilderness, as well as elsewhere (Ode).

According to Marriott, this species is not common or abundant, and the current condition is closest to Outcome E (suitable environments are highly isolated and they exist at very low abundance).

Salix serissima

According to Ode, this species is a disjunct relic in the Black Hills, as it occurs primarily in boreal bogs (e.g., in Manitoba). Suitable habitat for this species is very limited in the Black Hills.[1] It inhabits wet meadows with organic substrates.[1] There is one occurrence on Forest Service land in the McIntosh Fen Botanical Area. There is also one site on private land near Nahant. While in private ownership, McIntosh fen was ditched to concentrate and divert water flows for agricultural production. The Forest Service acquired the area about 1980, and recent (1997) efforts have been made to restore hydrologic function by filling ditches with hay bales and planting *S. serissima* seedlings rooted from cuttings. Ode stated his support for these restoration activities. Based on photographs of the area from 1930, the fen had much higher vegetation diversity prior to ditching, and aspen and willow have declined (Ode).

Marriott estimated the current condition for this species in the Black Hills to be Outcome E (suitable environments are highly isolated and they exist at very low abundance).

Sanguinaria canadensis

Ode indicated that this species is an eastern deciduous forest spring ephemeral that is disjunct in the Black Hills. It is shallow rooted and inhabits rich forest soils (Ode). This species can cross-pollinate for the first couple of hours after it blooms; after that, the bloom closes and the flower self-pollinates; a behavior that

[1] Clarification provided by Ode on 10/2/2000

might have evolved because it blooms in early spring, when few pollinators are present.[1] Ode stated that flowering early is a high-risk strategy for insect-pollinated plants. Ode also noted that the plant's seed is dispersed by ants and that the leaves may be poisonous to livestock. It is unknown if there is gene flow between sub-populations (Ode). Marriott deferred to the Forest Service on this species, recommended more surveys, and did not discuss the species further during the interview.

Scirpus cyperinus

This plant is a wetland species found on creek margins as an emergent and at the upstream end of beaver dams (Marriott). The populations Marriott has seen have always been under an open canopy, and sometimes with patches of willow. Ode stated that populations of this species occurred historically along Spring Creek and along Sylvan Lake, although they no longer exist. This species is thought to have been more widespread historically than it is now (Ode). There are currently populations in several locations in the Bearlodge Mountains and in Norbeck Wildlife Preserve. Ode indicated that more populations would likely be found with the survey of the Black Elk Wilderness scheduled for the summer of 2000. Ode noted that there were only two or three known populations in South Dakota in 1990 and there are now many more. He also stated Norbeck Wildlife Preserve populations are doing well. It is colonizing ditches, and the state of South Dakota has discontinued compiling information on this species. Ode was not concerned about the woolrush's viability, and did not comment further.

Marriott felt the current condition for this species in the Black Hills would be Outcome C (suitable environments are frequently distributed as patches or they exist at low abundance). This species occurs as widely separated clusters of populations or subpopulations.

Viola selkirkii

Ode stated that there are three currently known occurrences in the Black Hills (two in Sunday Gulch in Custer State Park, one in Norbeck Wildlife Preserve), with the probability more will be found during surveys to be done in the Black Elk Wilderness the summer of 2000. Only one of the three known occurrences is on Forest Service land.[1] In 1993 Dr. Gary Larson led floristic surveys of the entire Norbeck Wildlife Preserve (outside of the Black Elk Wilderness) and did not find any additional sites (other than the one cited above).[1] Within the Black Hills, this species inhabits spruce forested, cold air drainages often associated with cliffs.[1] Seeds are dispersed by ants.[1] All three of these occurrences are within the granitic area of the central Black Hills.[1] Ode added that there is also a single collection of this species from Deer Mountain in the northern Black Hills, but that relocation efforts have failed and there have been no other discoveries, despite numerous sensitive species surveys in the northern Hills by the Forest Service, by the mining companies, and by the Heritage Programs.[1] Marriott deferred to

[1] Clarification provided by Ode on 10/2/2000.

the current work the Forest Service is doing on this species, and did not comment further during the interview.

Effects of Proposed Activities

According to Marriott, changing Alternative 1 Guideline 1104 ("minimize soil compaction…") to a standard in Alternative 2 will be an improvement to all plant species (including sensitive plants).

Marriott felt changing Alternative 1 Guideline 1202 ("move stream channels only if all other practical alternatives to protect critical resources…") to a standard in Alternative 2 would not result in a significant difference between the alternatives. Anything that alters the landscape could negatively impact sensitive species.

Marriott was unsure about the impact to sensitive plants of Alternative 1 Guideline 1303 ("vegetative type conversion should only be done in riparian areas to re-establish riparian vegetation for the protection and/or enhancement of those ecosystems"). She stated that effects could be positive or negative depending on what is being done and where.

Marriott could not address effects of proposed activities on *Botrychium campestre* because so little is known about the species or where it may be located.

Timber Harvest

Marriott recommended against using timber harvest to achieve late succession conditions sooner, because the process by which an area becomes late succession is as important as the end product. Guideline 3.7-2101 ("applicable management activities should replicate biological processes…and strive to replicate natural vegetative patterns and patch size") will not allow the range of natural variability desired in the late succession landscape (Marriott).

Marriott suggested that timber harvest would not directly affect birch community obligates' potential habitat, but road construction and other activities related to logging would likely be detrimental.

In Marriott's opinion, changing guidelines in Alternative 1 to standards in Alternative 2 does little to directly benefit sensitive plant species. Preserving marten habitat by protecting spruce communities would be beneficial to many of the unusual Black Hills plant species, but does not relate to the species on the list of sensitive plants (Marriott).

Adiantum capillus-veneris* and *Epipactis gigantea
According to Ode, this activity will have no effect on these two species over the next five years.

Botrychium campestre
Marriott felt this species could, or probably would be impacted by timber activities if they occurred where the plants occur, since the species may occur in pine forest.

Corallorhiza odontorhiza
In Ode's opinion, the effects of timber harvest on this species are unknown. Marriott felt this species could, or probably would, be impacted by timber activities if they occurred where the plants occur, since they may occur in pine forest.

Equisetum scirpoides
According to Ode, the effects of timber harvest on this species are unknown. Standards and guidelines protecting riparian areas appear to protect existing populations (Ode).

Lycopodium complanatum
In Marriott's opinion, this activity will have no effect on this species.

Platanthera orbiculata
In Ode's opinion, if harvest does not occur on the existing sites, there should be no impact. Marriott concurred that timber harvest would not directly affect populations of this birch community obligate.

Sanguinaria canadensis
Ode could not say what the effects of timber harvest might be on this species. He assumed there could be short-term harm, but didn't know what the long-term effects would be. This applies to both alternatives.

Viola selkirkii
Ode assumed timber harvest would have no effect on this species since logging will not occur in the Black Elk Wilderness site.

Hardwood and Meadow Restoration

Lycopodium complanatum
In Marriott's opinion, this activity will have no effect on this species.

Platanthera orbiculata
Ode indicated that restoration of hardwood communities (not just restoring aspen clones) might benefit this species. He suggested that spruce expansion be evaluated prior to adopting the marten interim direction (MAR2).

Salix serissima

In Ode's opinion, if Standard 12 (MAR2) in Alternative 2 ("prevent further decrease in patch size of late-successional forests within areas currently occupied by marten or with high potential for occupancy…") prevents aspen restoration adjacent to the McIntosh Fen, there would be a deleterious effect on the fen, which would have negative effects on this species.

Roads and Travel Management

According to Marriott, Guideline 3106 as a standard in Alternative 2 would be a slight improvement because riparian areas and wetlands would not be disturbed by road construction. She strongly recommended locating roads outside of drainage bottoms. Many of the sensitive plant species occur in birch/hazelnut drainages in the northern Black Hills (Marriott).

In Guideline 3107(a), removing the wording "to the extent possible" when making a standard for Alternative 2 would be an improvement (Marriott).

In Marriott's opinion, converting Alternative 1 Guidelines 9107 and 9108 to standards in Alternative 2 would benefit some of the sensitive plant species.

Marriott felt that restricting off-road travel in botanical areas would be beneficial to sensitive plant species. She suggested that Alternative 1 Guidelines 3.1-9101 and 9102 be considered environmentally protective and become standards in Alternative 2.

Adiantum capillus-veneris* and *Epipactis gigantea

Regarding the direction of effect, Ode indicated Forest Plan road guidelines and standards definitely resulted in reduced effects to the habitat over the last year (i.e., road located further away from stream than originally planned) but they did not solve all the problems (siltation from non-Forest Service lands into stream still occurred, etc.).

In Alternative 1, direction of effect would be negative or neutral. Changing guidelines to standards in Alternative 2 would be more protective than Alternative 1, and direction of effect would then be neutral (Ode).

Ode recommended a standard for Cascade Creek/Spring that would restrict new road and trail construction because of the unique and sensitive nature of the warm spring ecosystem and its sensitive species. It is difficult if not impossible to make a general prescription in the Forest Plan for managing Cascade because of its dual nature as a highly popular recreation site and an extremely important botanical site (Ode).

Ode indicated an unknown duration of effect for this activity, because it is unknown what road and trail activities will occur. He assessed the overall level of management activity as minor, based on the amount of construction completed within the last two years.

Corallorhiza odontorhiza
The effects of road construction on this species are unknown, although it may recolonize following road reclamation (Ode).

Equisetum scirpoides
In Ode's opinion, major earth-moving activities would have the biggest effect on this species.

Lycopodium complanatum
According to Marriott, this activity will have no effect on this species.

Platanthera orbiculata
Marriott indicated that road construction would likely be detrimental to populations of this species.

Livestock Grazing

In Marriott's opinion, Alternative 2 Standard 20(4) (GRZ4) is not clearly more protective than Alternative 1 Standard 3.1-2501. Marriott would prefer the standard read "protect sensitive plant populations in designated botanical areas from adverse impacts of livestock, including not allowing grazing if it conflicts with sensitive plant species and values of the botanical areas.

According to Marriott, Guideline 2207 ("locate livestock/wildlife water sites outside of hardwood communities when feasible") would be beneficial as a standard in Alternative 2; she also stated it would be more beneficial if the wording "when feasible" was removed.

Marriott suggested that water sources not be developed (Guideline 1208) if the Forest Service is trying to protect sensitive species. Similarly, if there are sensitive species present at seeps or springs, she recommended they not be developed for water sources (Guideline 3104).

Marriott stated that most sensitive plant species are found in locations that are not attractive for forage to livestock. However, trailing and use of habitat for shade are related activities that would negatively impact sensitive species (Marriott).

Marriott felt that Alternative 2 is an improvement over Alternative 1 for the trailing issue related to livestock grazing, but it would only help in areas where

water developments are done. The change from guidelines to standards will not be an improvement for areas with flowing streams (Marriott).

Adiantum capillus-veneris* and *Epipactis gigantea
In Ode's opinion, this activity will have no effect on these two species over the next five years and was not further discussed during the interview. Marriott felt these two species could be impacted if grazing were to occur in the area of the warm spring ecosystem, although this area is not grazed at this time (Marriott).

Carex alopecoidea
Marriott expressed that livestock grazing is a concern for this species, and specific impacts would depend on amount of grazing, trailing, use for shade, etc. She has seen many trampled birch bottoms. Marriott stated that cattle would graze on wetland vegetation if grazing was intensive, but the more common impacts at lower intensity grazing levels would be trailing and use for shade. This species could be impacted by livestock trailing or accessing water, although cattle probably wouldn't forage on the plant itself (Marriott).

Corallorhiza odontorhiza
According to Ode, the effects of livestock grazing on this species are unknown.

Equisetum scirpoides
Ode noted that this species appears to be unpalatable to livestock. He also stated that in areas where grazing occurs, trampling and bank destabilization may affect this species, but it is unknown whether this would have a positive or negative effect. At this time, it is unknown how grazing affects this species (Ode).

Marriott expressed that livestock grazing (primarily trailing) is a concern for this species because it occurs in drainage bottoms. Specific impacts would depend on amount of grazing, trailing, use for shade, etc. She has seen many trampled birch bottoms. Cattle will graze on wetland vegetation if grazing is intensive, but the more common impacts at lower intensity grazing levels would be trailing and use for shade. Marriott also stated that she was not familiar with habitats in the southern part of this species range in the Black Hills, so she could not discuss effects.

Lycopodium complanatum
According to Marriott, the site at Sand Creek is on Forest Service land within the Sand Creek Botanical Area. In Marriott's opinion, Guideline 2207 ("locate livestock/wildlife water sites outside of hardwood communities when feasible") would be beneficial as a standard in Alternative 2 if the wording "when feasible" were removed.

Muhlenbergia glomerata
Marriott expressed that livestock grazing is a concern for this species, and specific impacts would depend on amount of grazing, trailing, use for shade, etc. She has seen many trampled birch bottoms. Cattle will graze on wetland vegetation if grazing is intensive, but the more common impacts at lower intensity grazing levels would be trailing and use for shade (Marriott).

Platanthera orbiculata
Ode indicated that livestock grazing could potentially damage populations of this species and their habitats. However, the plants occur in sites that livestock are not attracted to because there is better forage elsewhere and the sites are on steep slopes (Ode). These assumptions are dependent on a reasonable stocking rate (less than or equal to current levels), although trailing could be a concern regardless of stocking rate (Ode).

In Marriott's opinion, Guideline 2207 ("locate livestock/wildlife water sites outside of hardwood communities when feasible") would be beneficial as a standard in Alternative 2 if the wording "when feasible" were removed.

Marriott expressed that livestock grazing is a concern for this species, and that specific impacts would depend on the amount of grazing, trailing, use for shade, etc. She has seen many trampled birch bottoms. Cattle will graze on wetland vegetation if grazing is intensive, but the more common impacts at lower intensity grazing levels would be trailing and use for shade (Marriott).

Salix serissima
While livestock are currently excluded from the McIntosh Fen Botanical Area, Marriott felt that if the site were grazed, there would be a negative impact.

Sanguinaria canadensis
Ode's main concern is trampling of shallow roots by livestock, since vegetative reproduction is important. Bloodroot vegetation contains toxins that probably make it unpalatable to livestock, although some wildlife species may eat it.[1] Rockwood and Lobstein (1993) indicate that this species is affected little with less than 50 percent defoliation, although complete defoliation eliminates production.[1]

Marriott expressed that livestock grazing is a concern for this species, and specific impacts would depend on amount of grazing, trailing, use for shade, etc. She has seen many trampled birch bottoms. Cattle will graze on wetland vegetation if grazing is intensive, but the more common impacts at lower intensity grazing levels would be trailing and use for shade (Marriott).

[1] Clarification provided by Ode on 10/2/2000.

Scirpus cyperinus
Marriott expressed that livestock grazing is a concern for this species, and specific impacts would depend on amount of grazing, trailing, use for shade, etc. She has seen many trampled birch bottoms. Cattle will graze on wetland vegetation if grazing is intensive, but the more common impacts at lower intensity grazing levels would be trailing and use for shade (Marriott).

Viola selkirkii
Ode assumed livestock grazing would have no effect on this species since grazing will not occur at known sites in Norbeck Wildlife Preserve and Black Elk Wilderness.

Noxious Weeds

Marriott thought converting Guidelines 4304 and 4305 to standards in Alternative 2 would be beneficial, because it would control herbicide application more closely. Some sensitive plant species may benefit if noxious weed control is applied specifically and more closely controlled rather than by broadcast spraying (Marriott).

Adiantum capillus-veneris* and *Epipactis gigantea
Ode viewed the direction of effect of noxious weeds on these two species as a double-edged sword, as preventing invasion of exotics benefits native species, but weed control methods (including bio-control) are almost always harmful. He noted that language referencing integrated pest management is absent from the noxious weed standards, although it is included for insects and disease. According to Ode, some weeds like *Euphorbia esula* (leafy spurge) could be very disastrous to the Cascade Spring/Creek area, even though spurge would not likely inhabit the same locations as *E. gigantea* and *A. capillus-veneris*. However, aggressive broadcast spraying for weed control would likely be very detrimental to the general habitat area (Ode).

According to Ode, the duration of effect for this activity presents two separate scenarios: 1) invasion of exotic species would have a long-term effect; and 2) noxious weed control activities would have a short-term effect. *Lythrum salicaria* (purple loosestrife) would be the worst weed species that could become established in Cascade Creek/Spring area (Ode). Regarding the overall level of management activity, Ode thought it would be minor.

According to Ode, Alternative 1 Guidelines 3106 and 3107 becoming standards in Alternative 2 would benefit these two species.

Ode suggested retaining the “protecting other resources” language when converting Alternative 1 Guideline 4302 (“use biological control methods whenever practical, and whenever protecting other resources is desired, such as water quality”) to a standard in Alternative 2. He also questioned whether

the language of Alternative 1 Guideline 4302 would be modified to delete the phrase "whenever practical" when changed to a standard in Alternative 2. Ode stated that there are cases where a broadband herbicide is not recommended and suggested biological control methods be considered in these cases.

Ode felt it is unknown how weed control will affect these two species in Alternative 1 vs. Alternative 2. He was uncertain about how guidelines transformed to standards would be used. The existing standard about using weed-free hay, mulch, etc. is very important (Ode).

Marriott stated that noxious weed control could have positive or negative effects on these two species, depending on how it is done. *E. gigantea* would be out-competed by *Cirsium arvense* (Canada thistle) on disturbed sites; it is unknown what the effect on an established *E. gigantea* population would be. *C. arvense* is very aggressive when given the opportunity, such as open, disturbed habitats (Marriott).

Equisetum scirpoides

According to Ode, for the most part, this species occurs immediately adjacent to water, and therefore it is less vulnerable to invasion (except for purple loosestrife), and to control methods. Standard 4308 provides direction regarding application of chemicals near water.

Salix serissima

Ode expressed that noxious weeds, specifically *Cirsium arvense*, are probably a threat to this species. Treatments are and would be beneficial to this species if applied correctly (Ode).

Sanguinaria canadensis

Ode did not know whether there are existing weed problems in populations of this species but the habitat is probably vulnerable to weed invasion.[1] *Cirsium arvense* could forseeably out-compete bloodroot.[1] Chemical treatment could be detrimental, because bloodroot is a broadleaf plant like thistle, although there may be new species-specific chemicals that would not affect the bloodroot.[1] Chemical treatment after bloodroot goes dormant (2-3 week window in fall before thistle seed dispersal, longer if seed dispersal not considered) may not be detrimental.[1] Mechanical treatment is another option.[1]

Mining

In Marriott's opinion, Guideline 1516 regarding leasable minerals ("negative recommendations or consent denials will be based on consideration of …slopes steeper than 60%…low visual absorption capability…habitat of

[1] Clarification provided by Ode on 10/2/2000.

individual plant or animal species identified as needing special management…") as a standard in Alternative 2 would be an improvement over Alternative 1. Marriott also recommended that botanical areas be withdrawn from mineral entry.

Adiantum capillus-veneris* and *Epipactis gigantea
According to Ode, this activity would have no effect on these two species over the next five years.

Carex alopecoidea
Marriott stated that if mining moves onto Forest Service lands in the northern Black Hills, this species could be affected. *C. alopecoidea* could be heavily impacted by mining (Marriott).

Corallorhiza odontorhiza
According to Ode, substantial ground disturbance from mining would have negative effects on this species.

Equisetum scirpoides
Ode stated that major earth-moving activities would have the biggest effect on this species. Marriott stated that this species occurs right at the water's edge and could be seriously impacted by mining activities.

Lycopodium complanatum
In Ode's opinion, Alternative 2 has benefits over Alternative 1 for this species due to Guideline 1516 regarding leasable minerals ("negative recommendations or consent denials will be based on consideration of …slopes steeper than 60%…low visual absorption capability…habitat of individual plant or animal species identified as needing special management…") becoming a standard.

According to Ode, duration of surface mining is permanent. Placer mining is less permanent and takes place in creek bottoms where the plant does not occur (Ode). In Ode's opinion, the overall level of activity would be expected to be zero over the next five years.

Marriott stated that if mining moves onto Forest Service lands in the northern Black Hills, this species would be affected.

Platanthera orbiculata
Marriott felt that mining, especially surface mining, could affect this species. If mining moves onto Forest Service lands in the northern Black Hills, this species would be affected (Marriott).

Sanguinaria canadensis
Marriott indicated that if mining moves onto Forest Service lands in the northern Black Hills, this species could be affected.

Prescribed Fire

Adiantum capillus-veneris* and *Epipactis gigantea
According to Ode, this activity would have no effect on these two species over the next five years.

Recreation

Adiantum capillus-veneris* and *Epipactis gigantea
According to Ode, both species are located within developed recreational areas with high use. Both occur basically along the water's edge, out of the way of most direct recreational impact (Ode). Ode indicated that recreational concerns include trampling, bank destabilization, weed control, and vegetation management (e.g., spraying, mowing, etc.).

Ode stated that the direction of effect would be negative under both alternatives; intensity of effect is unknown; and the population trend is unknown although recreational activity has been occurring many years. The effects of recreation to pollinator(s) of *E. gigantea* are also unknown (Ode).

Ode stated that recreation is an ongoing activity at Cascade Springs, so duration of effect would be chronic and long-term under both alternatives. It is unknown how long effects would last if all recreational use in the area were ceased (Ode).

Ode stated that approximately 50 percent of habitat is affected by recreation; hence, the overall level of activity is widespread. *A. capillus-veneris* is very quick to recolonize, whereas *E. gigantea* may not. According to Ode, the traditional concern about Cascade Springs has been focused on reliability of the warm spring source. Recent U.S. Geological Survey professional opinion is that the source of Cascade Spring water is fairly deep, so it probably is not as vulnerable to local development (i.e., dewatering by wells for housing developments) as was once thought (Ode). Because of seed source and water security, *A. capillus-veneris* appears secure. *E. gigantea* may be a different situation (Ode), although Williams (1990) summarizes reports suggesting that *E. gigantea* also has the ability to quickly colonize suitable habitats.[1]

Marriott stated that recreation could have negative effects on these two species if not properly controlled. She suggested minimizing disturbance in the riparian zone, including recreational development, and not encouraging

[1] Clarification provided by Ode on 10/2/2000.

access to the creek. She suggested little or no new development in the riparian zone.

Salix serissima
McIntosh Fen provides a blue ribbon, walk-in fishery, although there is not a well-defined trail. A designated snow mobile trail also crosses through the Botanical Area, but not the fen itself. Alternative 1 Guideline 3.1-9103 ("over-the-snow motorized travel is restricted to designated routes and areas") would apply. Marriott indicated that snow compaction and resultant later melting might have an impact. There has not been a negative effect from these activities so far. Ode felt that if recreation levels do not change, there likely would not be a change in effects. Alternative 2 may be more protective by changing Guidelines 3.1-9102 and 9103 to standards (Ode).

Mowing

Adiantum capillus-veneris* and *Epipactis gigantea
According to Ode, the direction of effect of mowing is unknown, and the duration of the effect is short-term. Regarding the overall level of effect, Ode stated that the effect of this activity is not a direct effect to these species. The habitat of plants is not being mowed, but mowing could direct traffic. Indirect effects of mowing are unknown (Ode).

Overall Effect on Capability to Support Sensitive Plants

Marriott felt that Alternative 1 Guidelines 2107, 2201, 2202, 2411, 4105 and 1.1A-2103 are environmentally protective and suggested that they become standards in Alternative 2 (Marriott).

In Marriott's opinion, changing Alternative 1 guidelines for botanical areas to standards in Alternative 2 would be more protective than Alternative 1 for the following sensitive plant species: *Lycopodium complanatum, Platanthera orbiculata, Carex alopecoidea, Equisetum scirpoides, Salix serissima,* and perhaps others.

Adiantum capillus-veneris* and *Epipactis gigantea
According to Ode, the overall effect would be neutral (based on discussion above, the populations of *E. gigantea* and *A. capillus-veneris* would remain at roughly current levels), but there are so many unknowns that monitoring would be essential to determine and then prevent negative or strongly negative effects. Ode stated that The Nature Conservancy has acquired private land between Cascade Springs and Cascade Falls, and improved riparian management will be implemented. This will likely provide new or improved habitat for these two sensitive species (Ode).

Marriott recommended careful monitoring of these two species, along with tracking of recreational activities to ensure the populations are protected.

Botrychium campestre
In Marriott's opinion, the overall effect of management activities on this species is unknown because there is so little existing information about the species or where it may be located. It may occur in pine habitat, which would be highly affected by management activities, but it is unknown at this time (Marriott).

Corallorhiza odontorhiza
Ode indicated the overall effect to this species is unknown for both alternatives, because there are so few records and so little information. The species could be extirpated, or it could show up next year by the hundreds. Ode recommended admitting effects from management are unknown. Marriott referenced a treatment of orchids of North America, and suggested a literature search of the Rocky Mountain Herbarium and other locations. Marriott also recommended intensive surveys for this species or there may be big losses in the next five years. Marriott concurred that overall effects are unknown. This species may occur in pine habitat, which would be highly affected by management activities, but it is unknown at this time.

Carex alopecoidea
In Marriott's opinion, changing Alternative 1 guidelines for botanical areas to standards in Alternative 2 would be more protective than Alternative 1 for this species.

Equisetum scirpoides
According to Ode, there would be little change in this species (positive or negative) in five years.

Lycopodium complanatum
Since three of four known populations are on private land and the one occurrence on Forest Service land is in a botanical area, Ode felt it is unlikely there will be much effect over the next five years on Forest Service land.

Platanthera orbiculata
If the Black Hills gets a lot of rain in the next five years, there may be more plants, although a drought may cause a decrease in the number. Climate is important and may play a larger role in affecting populations than Forest Service management activities (Ode).

Salix serissima
Overall effect to this species is neutral (Ode).

Sanguinaria canadensis
In Ode's opinion, it was unlikely that this species would be extirpated in the next five years if the past were any predictor of the future, due to the abundance and distribution of existing populations. Options for maintaining or improving populations would not be permanently lost over the next five years (Ode). Marriott deferred to the Forest Service on this species, and recommended more surveys before addressing overall effect on the capability to support the species.

Scirpus cyperinus
Ode had no viability concerns for this species. The State of South Dakota has stopped compiling information on this species from the plant element list and the State rank was changes from S2 to S4.

Viola selkirkii
Both alternatives would have a neutral overall effect to known populations of this species on Forest Service land, although there is a question regarding impacts of recreation (Ode).

General Comments and Recommendations

Marriott recommended approaching the species viability issue with a process similar to that used by The Nature Conservancy, which addresses plant communities for the long-term. A coarse filter/fine filter methodology is used, whereby common species are monitored via habitat/community monitoring and consequently protected (coarse filter). Rare species that fall out at this coarse filter level are monitored at the species level (fine filter).

Marriott stated that the Black Hills is an intensively managed forest, which is difficult to see as a positive for sensitive plant species. A broad standard such as "no management activities are allowed in birch/hazelnut communities" would be something that would make a significant difference in benefiting sensitive plants.

Marriott was concerned that regardless of what direction the Forest Plan provides. Implementation on the ground does not always follow that direction. For example, construction of a road through a drainage could destroy a large bloodroot population. According to the Forest Plan, this would not happen, but Marriott was uncertain implementation would occur.

If the Forest's goal is protection of sensitive plant species and not foreclosing future options for viability over the next five years, Marriott recommended taking a cautious approach in planning, design, and implementation for two reasons:

1. There is a huge lack of information and there will always be insufficient information because ecology is complex and because of the large role stochastic events play.

2. The Forest Service does not have the resources to ensure that all standards and guidelines are implemented as written. For example, if a road is to be built with mitigation (e.g., locate road a certain distance from a sensitive plant population), she suggested not building the road because the sensitive plant population may still be impacted because mitigation measures either may not be implemented or may not be effective.

Marriott suggested that activities not occur adjacent to sensitive plant species or their habitats, although it is difficult to define sensitive species habitats narrowly in the Black Hills. She recommended that accepted guidelines of conservation biology be used in determining "conservation areas" (bigger is better for sensitive species protection areas to maintain natural processes; buffers; etc.). Marriott advocates this approach rather than a piecemeal approach of implementing projects and dealing with sensitive species when they are encountered and get in the way. Small, localized actions to protect species do not make sense in trying to ensure species protection. Marriott suggested that sensitive species be addressed in a conservation approach that gives plant species priority over any activities and focuses on them first, i.e., what is best for the sensitive species as far as keeping activities away from them, in a manner erring on the side of conservatism for plant species protection. The designated botanical areas are along the lines of what Marriott sees as effective management for species and vegetation of concern.

Because of the two reasons listed above, Marriott could not determine whether or not management activities will or will not impact sensitive plant species. Marriott is an advocate for all species and significant natural areas and therefore could not endorse either Alternative 1 or Alternative 2 where sensitive species and management activities coexist everywhere.

To ensure there is no more degradation of sensitive species habitat, no more destruction of sensitive species, and take some small steps toward ensuring plant species viability in general, Marriott made several recommendations:

a. Perform no ground-disturbing activities (road construction, water developments, mining, timber harvest, etc.) and do not increase stocking levels in hardwood stands, riparian areas, spruce stands, and montane meadows.

b. Marriott suggested a comprehensive survey (rather than project by project) of all plants including sensitive species, even though the Black Hills is ahead of other forests with surveys. She suggested that a comprehensive flora be done for the Black Hills, similar to the effort by the National Park Service to develop a comprehensive flora of their parks over the next five years. Even though some districts have made progress in this direction, much work remains. There are varying definitions for a comprehensive floristic survey, including surveying over multiple seasons,

etc. The Rocky Mountain Herbarium at the University of Wyoming has a good methodology for floristic survey. In addition, she suggested an analysis be done to determine what surveys have been done where and what/where the gaps are. The Forest is fortunate that most sensitive species occur in moist, cool habitats in upper elevations and largely in federal ownership (except in the Lead/Deadwood area), rather than prairie-type habitat which is largely in private ownership and thus difficult to survey.

c. Develop a monitoring program for sensitive species. Some type of monitoring is recommended even though adequate survey to really define a good monitoring program is lacking. She suggested the Forest consider using surrogate targets for long-term species viability evaluations. She suggested this effort begin reasonably soon (do not wait five years to begin). Using plant associations as surrogates considers rare and endangered plant associations (rather than looking at all species). In the Black Hills, these associations would be riparian types, mountain meadows, spruce communities, and perhaps others. Marriott has seen the usefulness of the approach used by The Nature Conservancy/ABI that uses plant associations as targets for protection to capture common species for species viability protection. The Black Hills is ahead of other forests in this regard with the Natural Community Classification developed from 1995-1998. The process of designating Research Natural Areas or Botanical Areas would be useful in moving forward in determining what locations provide the best quality examples of different types.

INTERVIEW TEAM CONCLUSIONS

It is difficult, at best, to draw conclusions from the interview notes. Ode thought that overall the Forest would not lose management options over the next five years for the sensitive plants he commented on. He did not know effects for some species. Marriott, on the other hand, did not support either alternative, but instead gave several recommendations for preserving management options over the next five years, including a coarse-filter/fine-filter management approach.

The monitoring suggested by Marriott and Ode will be valuable in the next five years. There is such a lack of knowledge about many of these sensitive plants that a monitoring program will be important until more data is gathered.

Marriott recommended intensive surveys for many of the sensitive plant species. Marriott also suggested a comprehensive floristic survey across the Black Hills. This survey would not change management options in the interim period (Phase I); however, this option needs to be considered when assessing needs for the Phase II Amendment.

Marriott also suggested not allowing ground-disturbing activities (road construction, water developments, mining, timber harvest, etc.) and not allowing increases in livestock stocking levels in hardwood stands, riparian areas, spruce stands, and montane meadows. Marriott (pers. commun. 7/28/00) clarified this statement after the interview. Her intent was to suggest that these ground-disturbing activities not be allowed in hardwood stands, riparian areas, spruce stands, and montane meadows, unless sensitive species surveys have been completed. She suggested that any activities planned in these communities be designed to enhance their natural values.

Ode suggested that spruce expansion be evaluated prior to adopting the marten interim direction (MAR2). The marten interim direction would not prohibit treating hardwood stands if spruce is encroaching, but it could prevent treatments in late successional spruce stands for the purpose of expanding hardwoods. This may prevent improving habitat for *Platanthera orbululata*. However, Ode also noted that overall the Forest would not likely lose management options over the next five years for the sensitive plants he commented on.

Marriott suggested keeping roads out of drainage bottoms. Standard 1303 ("… relocate or implement mitigation measures for roads … currently located within the water influence zone.") provides for moving existing roads away from drainage bottoms. Guideline 3106 as a standard in Alternative 2 would be a slight improvement because riparian areas and wetlands would not be disturbed by road construction.

Marriott recommended against using timber harvest to achieve late succession conditions sooner, because the process by which an area becomes late succession is as important as the end product. She suggests that Guideline 3.7-2101 ("applicable management activities should replicate biological processes…and strive to replicate natural vegetative patterns and patch size") will not allow the range of natural variability desired in the late succession landscape (Marriott). However, it is sometimes desirable to manage late successional areas to protect them from natural disturbances, such as fire, that would set back succession to an earlier stage.

Marriott not developing water sources. She clarified this later in the interview by recommending against water development where sensitive species exist. This implies that surveys should be completed prior to developments.

Marriott suggested removing the phrase "whenever practical" from Guideline 4302 (biological weed control). However, keeping the guideline as it is would allow the Forest to use biological control methods even when it is not necessary for protecting other resources. It simply may be the most efficient or cost effective method. Therefore, no change was recommended for guideline 4302.

Phase I Recommendations

- No new road and trail construction in the Cascade Creek/Spring area. No new development in the Cascade Springs riparian area. Don't encourage new creek access points at Cascade Springs.

- Consider the following guidelines in the Forest Plan environmentally protective and treat them as standards in alternatives 2 and 3:

    a. Guideline 2107 ("pine encroachment on areas that have formed over grass or meadow vegetation may be treated to maintain forage base and landscape diversity…").

    b. Guideline 2201 ("disperse aspen/birch treatments across the Forest").

    c. Guideline 2202 ("in landscapes with multiple aspen clones, manage for a mix of structural stages…conserve the structural diversity of multi-storied stands").

    d. Guideline 2411 ("regeneration harvests of even-aged timber stands should not be undertaken until the stands have generally reached…culmination of the mean annual increment…exceptions may be made where resource management objectives or special resource considerations require earlier harvest…exceptions include serving specific management objectives such as forest health, wildlife diversity, and ecosystem restoration and management").

    e. Guideline 4105 ("when feasible and appropriate use broadcast burning to dispose of slash in order to return the inorganic and organic chemicals in the foliage and small woody material to the soil, to reduce fire hazard, and to provide seed beds for natural regeneration").

    f. Guideline 1.1A-2103("manage wilderness within the context of larger landscapes to ensure the protection and integrity of natural and biological processes").

    g. Guideline 3.1-9101 ("travel is restricted to designated routes").

    h. Guideline 3.1-9102 ("off-road motorized travel is prohibited").

- Combine Standards 3.1-2501 and GRZ(4) to read: "Protect sensitive populations in designated Botanical Areas from adverse impacts of livestock, including not allowing grazing if it conflicts with sensitive plant species and values of the botanical area."

- Change Guideline 2207 to: Locate new livestock/wildlife water sites (i.e., drinking structures) outside of hardwood communities.

- Change Guideline 3104 to a standard: "Protect habitat for sensitive plants and animals associated with moist soil conditions. Do not develop springs or seeps as water facilities where sensitive species exist or have the potential to exist."

- Guideline 3107a, remove: "to the extent possible."

- In hardwood stands, riparian areas, spruce stands, and montane meadows, permit no ground-disturbing activities and do not increase stocking (grazing) levels unless adequate sensitive species surveys have been completed.

- Continue sensitive plant surveys.

- Continue not allowing grazing in the portion of the McIntosh Fen Botanical Area currently closed to grazing.

- Monitor recreational activities and plant populations at Cascade Springs.

- Develop a monitoring program for sensitive species. Some type of monitoring is suggested, even though adequate survey to really define a good monitoring program is lacking. Consider using plant associations as surrogate targets as suggested by Marriott.

Phase II Recommendations

- Consider incorporating a coarse filter/fine filter approach in assessing species/population viability. Marriott recommended approaching the species viability issue with a process similar to that used by The Nature Conservancy, which addresses plant communities for the long-term. A coarse filter/fine filter methodology is used, whereby common species are monitored via habitat/community monitoring and consequently protected (coarse filter). Rare species that fall out at this coarse filter level are monitored at the species level (fine filter). Consider this approach, which is similar to the process currently being developed at the Regional Office for species viability, during the Phase II Amendment.

- Consider incorporating "conservation areas" as suggested by Marriott. Marriott recommended that accepted guidelines of conservation biology be used in determining "conservation areas" (bigger is better for sensitive species protection areas to maintain natural processes, buffers, etc.). Marriott advocates this approach rather than a piecemeal approach of implementing projects and dealing with sensitive species when they are encountered and get in the way. Small, localized actions to protect species

do not make sense in trying to ensure species protection. The designated Botanical Areas are along the lines of what Marriott sees as effective management for species and vegetation of concern. A broad standard such as “no management activities are allowed in birch/hazelnut communities” would be something that would make a significant difference in benefiting sensitive plants. Consider this approach in the Phase II Amendment.

- Consider the comprehensive floristic survey of the Black Hills suggested by Marriott, as part of the information needs assessment in the Phase II Amendment.

- Consider withdrawing botanical areas from mineral entry.

- Develop a monitoring program for sensitive species. Consider a continuation of the monitoring identified in Phase I or modify as necessary to address Phase II issues.

SURVEY AND MONITORING METHODS

Marriott expressed that monitoring plant populations is much more difficult than most people realize, for several reasons. First, some of the plant species of concern appear to have aboveground cycles longer than every year (e.g., they may appear every few years or have huge populations one year and then just scattered populations in other years). Secondly, there are also many different distribution patterns of individuals of different species (e.g., some species occur as huge patches, some only occur as scattered individuals). Finally, plant populations can move around over time. The ecology of each species must be known before an adequate monitoring program can be designed, to ensure the populations are being monitored rather than subpopulations or patches. In order to develop a monitoring program, Marriott recommended using systematic resurvey as a monitoring tool until better information is obtained. Resurvey would include recording site layouts, characteristics, plant distribution, plant health, etc. on a qualitative basis with a rigorous consistency of reporting/recording forms, rather than quantitative plots. Resurvey as a method of monitoring necessarily includes data analysis to determine what is learned about the ecology of each species, and to tailor the continuing resurvey or develop a different, more rigorous quantitative methodology for monitoring. Accurate resurvey is dependent on field personnel with good skills in botanical identification, orienteering, etc. Gross trends as well as some more specific trends will be identified in resurvey. Sampling cannot be done without sufficient knowledge of the species, or the sampling cannot be truly representative. Some believe statistical analyses are required with sampling data for it to be valid, but there are species whose populations are small enough that every plant can be counted and monitored at that level of detail. Based on Marriott’s experience, resurvey, as a monitoring tool would be defensible. She also thought it would be

more efficient for the value of data generated relative to what is already known, what is needed to be known, and the cost necessary to generate the information.

Corallorhiza odontorhiza

Because it can stay underground for periods, this species is difficult to monitor. Monitoring plot studies of orchids in general show a lot of variability in above ground location over time.

AMERICAN MARTEN

SPECIES:

- American Marten (*Martes americana*)

EXPERTS:

- Keith Aubry, Ph.D., Principal Research Wildlife Biologist, USFS Pacific Northwest Research Station, Olympia, Washington
- Jonathan Jenks, Ph.D., Associate Professor, South Dakota State University, Brookings, South Dakota
- Martin Raphael, Ph.D., Chief Research Wildlife Biologist, USFS Pacific Northwest Research Station, Olympia, Washington
- Len Ruggiero, Ph.D., Research Project Leader, USFS Rocky Mountain Research Station, Missoula, Montana

INTERVIEW RESULTS

Natural History Summary

There were differing opinions about whether the Black Hills is part of the marten's historical range. Raphael noted that range maps in the marten literature do not include the Black Hills, but Jenks pointed out that historical records exist. Ruggiero thought the species might be more abundant now than historically.

Interviewees had somewhat differing opinions on how the Forest defined high potential marten habitat (conifer stands with a spruce component and at least 40 percent canopy closure). Aubry thought the definition was appropriate. Studies in other parts of the Rocky Mountains suggest spruce is important, and in general, spruce habitats support the best prey (Raphael). Aubry stated that marten are not likely to use pure pine, but Jenks suggested that marten in the Black Hills might use pine forests for winter cover. Regardless, habitat is extremely variable across the marten's range (Raphael). Ruggiero indicated the Forest's definition includes more areas than what marten typically use, and therefore, the term would be more appropriately stated as "potential habitat," rather than "high potential habitat." Ruggiero recommended stating assumptions associated with the definition.

Because forest floor structure is very important to marten, Aubry recommended it be included in the definition of high potential habitat. This type of structure is

typically provided by herbaceous material, branches coming down to the ground, woody material, etc. (Aubry). In the Black Hills, marten likely use large slash piles (Raphael). The structure of late successional habitat is probably more important than age of the trees (Raphael). Subnivean (below snow) access and spaces are another component of structure (Aubry). In the Oregon Cascades, marten key in on riparian areas where trees are bigger and snags more abundant. In the Oregon Cascades, upland areas are intact (not harvested) but are not used much by marten (Raphael).

According to Ruggiero, good marten habitat generally is provided by mesic coniferous forest with high canopy closure (60%), large live trees, standing dead trees, and down woody material. Stand structure is complex, with a reasonable aerial extent (Ruggiero). Hargis et al. (1999) determined 600 km^2 is needed, with less than 25 percent in openings; an area less than 600 km^2 may not be large enough to function as good habitat. It may be reasonable to use Hargis' work as a template for the Black Hills (Ruggiero).

Based on the study currently being conducted by South Dakota State University, habitat model components established to date include areas within 100 meters of streams, mature spruce dominated stands with greater than 50 percent canopy cover, and elevations greater than 5200 feet (Jenks).

Raphael provided information on the predators and prey of marten. In the Black Hills, important prey likely include red squirrels (*Tamiasciurus hudsonicus*) and voles (*Clethrionomys* and *Microtus* spp.), while predators include bobcat (*Lynx rufus*), coyote (*Canis latrans*), red-tailed hawks (*Buteo jamaicensis*), and other marten.

Current Condition

Raphael and Aubry described the current status of the Black Hills marten population and available habitats in terms of Outcome D (suitable environments are highly isolated or exist at very low abundance). However, both experts felt additional information is needed for a more accurate assessment.

Raphael suggested that, since suitable habitats are not well defined at this time, the Forest support the on-going study (assist with funding) to get information on distribution and habitat use, to be able to adequately define high potential habitat. He suggested a study to determine habitat relationships, and a monitoring program that provides information on presence/absence and trend through time.

Ruggiero recommended that the Forest ascertain the status of marten in the Black Hills rather than make assumptions. He suggested collecting information on patterns of abundance. To better understand patterns of distribution, investigate historic and current habitat conditions, as well as marten abundance and distribution (Ruggiero).

Aubry suggested the Forest determine average late successional patch size, distance between patches, and conduct marten surveys over time to determine distribution. He also suggested the Forest implement small mammal surveys to determine prey base.

Jenks described the current status in terms of Outcome C (suitable environments are frequently distributed as patches or they exist at low abundance), based on patchiness of habitat, low abundance, isolation between northern and southern Hills populations (i.e., Spearfish Canyon and Black Elk Wilderness Area, respectively), and limited interaction.

Jenks also suggested there may be a problem with connectivity of habitats since populations have not dispersed and concentrations remain at reintroduction sites. Either suitable habitat never existed, or it did exist but was really patchy. Their study has found two martens moving between population centers (50% mortality), so there appears to be some connectivity, although it may be low. There is also a concern with availability of spruce habitat in the central Black Hills, and fragmentation (Jenks).

The South Dakota Game, Fish and Parks Department is considering a limited trapping harvest with mandatory check-in of carcasses and documentation of location taken. Jenks suggested this would reveal information on where juveniles and adults are coming from, sex and age distribution, and habitats being used. Ruggiero felt trapping may not be a good idea.

According to Jenks, the closest marten population is in the Bighorn Mountains in Wyoming, and there is no possibility of recolonization or connecting the two areas. The status of the marten in the remainder of its range is good (Jenks).

Effects of Proposed Activities

Timber Harvest

Jenks felt that Alternative 1 will cause continued habitat degradation since harvest is allowed in spruce (and marten habitat in particular); effects are long-term and moderate to widespread. Alternative 2 would have a neutral effect if there was no harvest in spruce and retention of more down logs (Jenks). It could have a positive effect if more down wood was left in pine stands adjacent to spruce (Jenks). Jenks recommended buffering out from spruce stands when harvesting adjacent pine to maintain moisture and micro-site characteristics. He also recommended avoiding thinning corridors.

Aubry felt pure ponderosa pine is not likely used extensively by marten. As long as high potential habitat is avoided (spruce component), Alternative 2 would be adequate (Raphael).

Raphael felt Standard 12 (MAR2) in Alternative 2, as written ("…prevent further decrease in patch size of late successional forests within areas currently occupied by marten…"), may be subject to interpretation and could be implemented in a number of ways. He suggested better defining areas with a high potential for marten occupancy.

Two snags or less per acre is adequate for marten if the snags are large enough; distribution is also important (Raphael). In pine stands, downed wood and slash piles may add to an area's usefulness to marten (Raphael). As was found in Chemult, Oregon, infrequent, large downed logs may be important as well as some slash piles (Raphael).

Forest biologists made an attempt to define what a sufficient amount of down woody material would be for marten habitat prior to the interviews. Ruggiero suggested sufficient down woody material probably would be more than six logs per acre, and larger than 8 inches diameter. He is not aware of any peer-reviewed data relating number of down logs per acre (or any other structure) to reproductive success. Without information on survivorship and reproductive fitness, it is difficult to define parameters or structural features for which to manage. Ruggiero suggested checking the National Council for Air and Stream Improvement (NCASI) reports (NCASI 1996, NCASI 1999) and the marten Habitat Suitability Index model (Allen 1984) for information on number of down logs. Raphael suggested not defining "sufficient downed material" in the Forest Plan amendment to retain flexibility to accommodate new information as it becomes available.

Aubry suggested creating piles or bundling small woody material (slash) to provide near-ground structure. This would increase or improve marten habitat in the short-term, and could be applied in pine stands adjacent to spruce, since these areas may be used for foraging (Aubry).

Aubry also recommended cull logs be spread out over the stand rather than piling them, although spreading may be cost prohibitive. To lower the cost, these trees could be identified before they are skidded to the landing. Heart rot logs make a better individual structure than as part of a pile (Aubry). Raphael shared results from a Chemult, Oregon study where small diameter lodgepole pine was subject to heavy salvage harvest, but marten were abundant. That study found randomly jumbled slash piles provide better habitat than systematically stacked piles, and they do not collapse as fast. Forty-five percent of summer marten use was in slash piles. There were five to ten piles per acre, approximately 20 ft^2 in size.

Hardwood and Meadow Restoration

Jenks felt both alternatives would have a neutral effect in pine habitats. Alternative 1 would cause continued habitat degradation if spruce were removed from hardwoods; it would be a long-term, and moderate to widespread effect. Jenks suggested leaving a buffer around streams and good marten habitat rather than harvesting right up to the edge.

Fuelwood Gathering

If fuelwood collection occurs in spruce stands, Jenks felt there could be negative effect to marten habitat, and a moderate amount of habitat would be affected. Public fuelwood collection from harvest slash piles may have little impact as long as the interiors of the piles remain intact (Aubry).

Fuels

Raphael felt that Forest Plan Objective 224 ("reduce or otherwise treat fuels commensurate with risks [fire occurrence], hazard [fuel flammability], and land and resource values common to the area…") might be a risk factor for marten habitat. He recommended balancing fuels objectives with marten needs.

Roads and Travel Management

Raphael stated that two-track roads do not usually affect marten movements. Increased road construction in high potential habitat would have negative impact due to fragmentation of habitat and direct population effects (road kills and access for trapping). There would be a neutral effect in other habitats. Forest roads do not contribute significantly to road kills, but paved roads can have population level impacts (Raphael).

Livestock Grazing

Jenks felt that both alternatives would cause degradation of marten habitat because grazing opens the understory, suppresses shrubs, and affects downed wood. He felt that effects would be medium- to long-term, and would be widespread. Jenks felt that 40 percent utilization (Guideline 2505) is too high, and suggested that perhaps lowering utilization in some areas would help lessen negative effects. Aubry suggested that the greatest impact of livestock grazing is to prey habitat through removal of understory vegetation. He qualified this comment by adding that grazing likely occurs in lowest quality marten habitat, because spruce areas generally are not as accessible to livestock as other forest types and generally produce little forage.

Noxious Weeds

Establishment of noxious weeds may negatively impact prey habitat, but it is unlikely (Raphael).

Insects and Disease

Jenks indicated that insect and disease control activities could have a negative effect if implemented in spruce stands or pine stands adjacent to spruce. The effect would be medium- to long-term, and could have widespread effect.

Prescribed Fire

Jenks felt that both alternatives would have a negative effect if implemented in marten habitat. However, effects would be short-term, and a minor amount of habitat would be affected. He also stated that prescribed burning in spruce habitats appears harmful to female martens. He did not further clarify how burning could potentially harm female martens.

Piles and downed wood may be lost during prescribed burning in some of the drier, upland sites. Protection of 1.3 piles per hectare would meet marten needs pretty well (Raphael).

Recreation

Aubry stated that marten are not very sensitive to disturbance, so trails along riparian areas would not have an impact. Raphael felt that there would be little impact to marten from snowmobiling. Jenks was not aware of any literature that has assessed the effect of off-road vehicles on marten and their habitats.

Overall Effect on Capability to Support Marten

Jenks felt that Alternative 1 would have a negative overall effect to marten over the next five years. Alternative 2 would have a neutral effect if there is no harvest of spruce stands, no reduction in down woody material, and limited impact on adjacent stands. Jenks suggested connectivity be “maintained” for the short-term by not thinning corridors. He also recommended long-term (Phase II) connectivity be “enhanced”. Aubry also felt that Alternative 2 would have a neutral effect in the short-term, while more information is gathered. Raphael suggested that Alternative 2 (increases in snags, retention of suitable habitat, larger patches of late seral habitat) would have more positive effects on marten habitat in the long-term, but wouldn’t improve habitat much in the short-term.

Ruggiero felt that while Alternative 2 is an improvement over Alternative 1, it still is not enough of an improvement. He recommended an additional alternative that would include but extend beyond Alternative 2. Assuming the Black Hills can support a viable marten population, he recommended a standard for managing spruce drainages, since these areas support prey and provide structural features associated with resting, denning, and foraging. He recommended that these areas have large trees >12 inches diameter at breast height (DBH). Drainage bottoms have the highest potential to grow large trees. Ruggiero suggested using an ecological approach when determining high potential marten habitat. Structurally diverse mesic areas could be managed on an extended rotation to benefit marten and many other species. He suggested the Forest consider conditions of moisture, slope, aspect, and drainages. Standards that prohibit unwanted activities are preferred over standards that allow certain activities in these areas. He suggested identifying seeps, drainages, and north slopes, starting with dendritic drainage patterns. To address connectivity, he suggested looking for breaks in these drainages. He suggested not using dry slopes to connect across a ridge because they are not likely to be used by marten. It would be better to manage less area for better quality habitat than more area for low quality habitat. He suggested the Forest try to minimize the area to which constraints apply, and maximize the likelihood of marten use and productivity (Ruggiero). Due to the limited amount of spruce habitats available, Ruggiero recommended buffering all riparian areas by 200 meters on each side, and restricting harvest in these areas. Raphael cautioned against this strategy in the short-term. Raphael was concerned that managing riparian areas for marten might lead to more isolation. Raphael felt that it is critical to understand range of natural variability for Black Hills rather than immediately applying information specific to other areas.

The definition of “high potential habitat” (areas with a high potential for marten occupancy) may need to be refined for Alternative 2. Aubry felt the Forest’s current definition is appropriate given the lack of better information at this time. Ruggiero, however, felt the current definition likely includes more areas than it should.

INTERVIEW TEAM CONCLUSIONS

The existing lack of information on marten distribution, abundance, and habitat use in the Black Hills caused all interviewees difficulty in determining the current condition and overall effects of proposed activities on the population. All those interviewed recommended gathering additional information for Phase II to better ascertain the status of the marten in the Black Hills. In addition, the question of whether marten occurred in the Black Hills historically significantly confounded the problem of lack of information. Spruce habitats have increased considerably relative to historical conditions (Parrish et al. 1996), so the Forest may have difficulty in providing habitats for a species that may not have occurred in the Black Hills historically, or occurred at low densities. Ruggiero felt the Forest might be

constrained in its ability to manage toward the range of natural variability if also managing for a species that is more abundant now than historically.

Of all the proposed activities discussed during the interviews, timber harvest was by far the activity that was of most concern to those interviewed. Jenks felt that Alternative 1 would cause continued habitat degradation since harvest in spruce is allowed. Jenks and Aubry both felt that Alternative 2 would have a neutral effect on marten habitats if there would be no harvest in spruce stands and increases in down woody material. Raphael felt that improvements in Alternative 2 would have more positive effects on marten habitat in the long-term, rather than in the next five years. The interviewees' recommendations regarding timber harvest were generally related to age class, structure, down woody material, and negative effects of harvesting adjacent pine stands. Raphael also cautioned against road construction in high potential habitat because it would cause habitat fragmentation and direct population effects.

According to the experts, Alternative 2 would have a neutral effect over the next five years if the Forest does not harvest or build roads in marten habitat, does not thin in connecting corridors, and maintains or increases down woody material in and adjacent to marten habitat. The experts suggested supplementing Alternative 2 with the following items:

- Do not build roads in potential marten habitat.
- Do not thin within connecting corridors.
- Maintain microclimate conditions within potential marten habitat.
- To improve marten habitat in the short-term, maintain piles of woody material for near ground structure where timber harvest occurs in or adjacent to potential marten habitat.

For the above recommendations, potential marten habitat needs to be defined. During the interviews, potential marten habitat was generally considered to be spruce stands and pine stands with a significant spruce component.

Generally, good marten habitat is provided by mesic coniferous forest with high canopy closure (40-60%), large live trees, standing dead, and down woody material (Ruggiero). Jenks is currently studying a habitat model that includes mature spruce dominated stands with greater than 50 percent canopy cover within 100 meters of a stream and 5200 feet elevation or above in the Black Hills. Range-wide, martens occupy many habitat types dominated by conifer trees (Allen 1984), but they show preference for areas dominated by spruce, fir, and hemlock species (Buskirk and Ruggiero 1994). Allen (1984) assumed that stands of mature or over-mature coniferous forests, comprised of 40 percent fir or spruce, with a total canopy closure greater than 50 percent, provided near optimal winter habitat. Ponderosa pine is not considered optimum habitat, although there is evidence that martens use pine habitat in the Black Hills (Fredrickson 1981). Rocks, low lying branches, fallen logs, stumps, lush forb and shrub vegetation, and subnivean sites provide both thermal

and protective cover as well as foraging habitat (Davis 1983, Spencer 1987, Buskirk 1984). Marten stay close to overhead cover, and are intolerant of habitat types lacking at least 30 percent canopy cover (Buskirk and Powell 1994, Clark et al. 1989). A study in California suggested a preference for 40 to 60 percent canopy cover at both resting and foraging sites, and avoidance of stands with less than 30 percent canopy closure (Spencer et al. 1983).

The interviews provided little information that helps define "sufficient" number and size of down logs in marten habitat. Ruggiero suggested sufficient down woody material probably would be more than six logs per acre, and larger than 8 inches diameter. The existing literature consistently indicates that marten prefer highly complex near-ground structure. At least ten logs per acre were recommended for California forests (optimal management recommended at $\geq$20 logs per acre of $\geq$15 inches DBH and $\geq$15' long) (Freel 1991; cited in USFS 1996). The marten Habitat Suitability Index (HSI) model (Allen 1984) assumes 20 – 50 percent ground cover of coarse woody debris (CWD) > 3 inches diameter provides optimal conditions. However, CWD levels less than 20 percent or greater than 50 percent were not assumed to severely limit the cover value for martens (i.e., these levels still provided habitat). In predominantly spruce/fir forests of southern Wyoming, almost 20 percent of all maternal dens were found within logs. The mean diameter of these logs was almost 21 inches (Ruggiero et al. 1998).

Jenks also suggested that fuelwood collection and prescribed burning in spruce stands could negatively affect marten. This indicates that monitoring of large downed woody material will be important over the next five years. Meeting the marten down woody material standard in Alternative 2 is will likely address fuelwood collection and prescribed burning in marten habitat.

In terms of recommendations for improving habitat suitability, Aubry suggested that creating piles would be something that could be done in the short-term. Small material (slash) could also be bundled together to create near-ground structure. Marten habitat may be increased or improved in the short-term by providing piles, even in pine stands adjacent to spruce, since these areas may be used for foraging (Aubry). Raphael suggested 1.3 piles per hectare would meet marten needs. Aubry also recommended cull logs be spread out over the stand rather than piling, although spreading may be cost prohibitive. He recommended identifying these trees before they are skidded to the landing to lower cost. Heart rot logs make a better individual structure than as part of a pile (Aubry).

Interviewee opinions varied on effects of grazing on marten. In Jenks' opinion, livestock grazing would degrade marten habitat in both alternatives, and suggested that utilization rates be lowered in potential marten habitat. However, Aubry suggested that grazing likely occurs in the lowest quality marten habitat. It is not clear from the interviews that grazing practices need to be changed to maintain marten habitat options over the next five years. As long as the microclimate conditions are protected in potential marten habitat, there should be no degradation

from grazing. This may require extra efforts in monitoring grazing levels in marten habitat.

None of the interviewees felt that other proposed management activities discussed (e.g., fuelwood gathering, noxious weeds, insects and disease, etc.) would have significant effects on marten or their habitats over the next five years. Jenks felt that fuelwood gathering has the potential to be detrimental to marten habitat by removing large down woody material.

Ruggiero suggested a strategy for managing for martens that buffers streams and riparian areas 200 feet on either side. Raphael disagreed with this approach, suggesting that it may lead to more isolation of marten habitat. More information is needed in understanding the range of natural variability for the Black Hills and to look at the merits of this approach as a landscape approach. Due to uncertainty expressed in the interviews, this approach is more appropriate to consider in the Phase II Amendment. The previously mentioned additions to Alternative 2 should maintain options over the next five years (Jenks, Raphael, Aubry).

Information provided by Hargis et al. (1999) could be useful in the Phase II Amendment as well. However, there are few areas on the Black Hills that meet Hargis' definition (600 acres of contiguous habitat with less than 25 percent in openings). The conclusion from the interviews is that options will be maintained over the next five years with the previously mentioned additions. Therefore, the suggestion to include areas of this size was included in the Phase II recommendations.

Forest Plan Objective 224 ("reduce or otherwise treat fuels commensurate with risks [fire occurrence], hazard [fuel flammability], and land and resource values common to the area…") might be a risk factor for marten habitat. Raphael recommended balancing fuel risks with marten needs, especially in spruce stands.

Phase I Recommendations

In addition to the marten standards in Alternative 2, add the following:

- To improve marten habitat in the short-term, maintain piles of woody material for near ground structure where timber harvest occurs in or adjacent to potential marten habitat (spruce or conifer sites with significant spruce component). Raphael suggested maintaining 1.3 piles per hectare.

- Maintain microclimate conditions within potential marten habitat (spruce or conifer sites with significant spruce component).

- In areas identified as important connectivity corridors for marten, maintain canopy closure and density (i.e., do not thin).

- Avoid building roads in potential marten habitat (spruce or conifer sites with significant spruce component).

- Monitor down woody material in marten habitat.

Phase II Recommendations

- Since marten habitat relationships are not currently well defined, Ruggiero recommended the Forest ascertain the status of marten in the Black Hills rather than make assumptions. Investigate historic and current habitat conditions, as well as marten abundance and distribution (Ruggiero). Raphael recommended supporting the on-going study to obtain information on distribution and habitat use.

- The interviewees pointed out several information gaps. Aubry suggested the Forest determine average late successional patch size, distance between patches, and conduct marten surveys over time to determine distribution. Raphael recommended a complete analysis for old growth related species and their snag requirements, as well as better identification of the spruce component in pine and hardwood stands. Aubry recommended small mammal surveys to determine prey base.

- Establish a monitoring program to gather information on the marten population through time.

- Develop a strategy to enhance connectivity in marten habitat.

- Consider Ruggiero's recommendation in the Phase II Amendment. Assuming the Black Hills can support a viable marten population, Ruggiero recommended standards for managing spruce [drainage] bottoms, since these areas support prey and provide structural features associated with resting, denning, and foraging. He suggested that these areas have large trees >12 inches DBH. Drainage bottoms have the highest potential to grow large trees. The Forest may also want to consider all riparian areas and buffer 200 meters on each side, given the limited amount of spruce. Ruggiero recommended a standard to restrict harvest in these areas. Ruggiero suggested using an ecological approach when determining high potential marten habitat. Structurally diverse mesic areas could be managed on an extended rotation to benefit marten and many other species. Consider conditions of moisture, slope, aspect, and drainage bottoms. Standards that prohibit unwanted activities are preferred over standards that allow certain activities in these areas. He suggested the Forest identify seeps, drainages, and north slopes, starting with dendritic drainage patterns. To address connectivity, he suggested

the Forest look for breaks in the dendritic drainage patterns of riparian areas. He suggested not using dry slopes to connect across a ridge because it isn't likely to be used. It is better to manage less area for better quality habitat than more area for low quality habitat. He suggested the Forest try to minimize the area to which constraints apply, and maximize the likelihood of marten use and productivity (Ruggiero).

- Consider Hargis's (1999) work as a potential strategy in the Phase II Amendment. It may be reasonable to use Hargis' work as a template for the Black Hills (Ruggiero). Hargis et al. (1999) determined 600 km^2 of habitat is needed, with less than 25 percent in openings; an area less than 600 km^2 may not be large enough to function as good habitat.

- Address roads and travel management in the Phase II Amendment. Current access management policy appears to be adequate for the next five years, but some concern was expressed about road densities and new road construction in marten habitat. Concerns were mainly related to the reduction of snags and downed woody material due to increased fuelwood collection that comes with improved access. Road densities may also be a concern if marten trapping is resumed on the Forest.

SURVEY AND MONITORING METHODS

Properly design any surveys undertaken, including track plate surveys (Raphael). Aubry noted camera stations with meat bait (which marten are very attracted to) have been used successfully. This type of survey is best performed during winter. Raphael feels snow track surveys yield inconsistent results (hit and miss). He recommended a combination of track surveys supplemented with camera stations to get good data for the Phase II Amendment. A combination of intensive systematic survey (random or grid), with additional effort in the most likely habitat would be most productive. Aubry indicated Stage I plots have been used as survey units in California and Oregon. This method ensures a standardized and unbiased approach in determining forest-wide distribution. Aubry suggested small mammal surveys using snap trap lines to get an idea of what prey is available. Snap traps do not have to be checked daily.

Jenks recommended the Forest obtain notes from the recent Interagency Mammal Meeting for survey/monitoring techniques.

BATS

SPECIES:

- Townsend's Big-eared Bat (*Plecotus townsendii*)
- Fringe-tailed Myotis (*Myotis thysanodes*)
- Spotted Bat (*Euderma maculatum)*

EXPERTS:

- Lyle Lewis, Western Bat Working Group Chairman, Bureau of Land Management, Twin Falls, Idaho
- Bob Luce, Nongame Mammal Biologist, Wyoming Game and Fish Department, Lander, Wyoming
- Joel Tigner, Private Consultant, Batworks, Rapid City, South Dakota

INTERVIEW RESULTS

Natural History Summary

According to Lewis, female bats likely prefer south- and west-facing slopes with warmer temperatures for maternity roosts, which suggests a need for as many snags as possible on south- and west-facing slopes. Males typically use a diversity of aspects (Lewis). According to Tigner, female and juvenile bats are observed at lower elevations during summer.

Tigner indicated most large roosts for Townsend's and fringe-tailed myotis have been found on the Limestone Plateau or around the edge of the limestone. They live in these areas year-round and hibernate underground. A lot of caves are used only for night roosting (Tigner). Luce noted that particular roost sites provide different habitat to different bats. For example, a night roost for some bats may be a day roost for others. Lewis stated it is rare for a cave to provide habitat as both hibernacula and a maternity roost, due to varying temperature requirements of different bat species and sexes at various times of the year.

Most hibernacula caves stay just above freezing in colder portions of the West, but there is quite a lot of geographic variation (Lewis). According to Luce, hibernacula often serve as mating sites; mating for some species takes place immediately before bats go into torpor. Changing (through activity or disturbance) anything about a site that is used by bats may alter its suitability for bats (Luce).

Maintaining foraging habitat in close proximity to roosts is another critical factor in protecting habitat (Luce). Bats are closely associated with riparian areas for foraging (Tigner). Wetlands and meadows are important foraging areas (Luce). Bats obtain water while flying, so availability of open water sources is another critical component of bat habitat (Luce).

Although large groups of roosting bats are generally thought of as indicating suitable bat habitat, the presence of one bat indicates suitable habitat as well (Luce). This is because male bats are solitary roosters.

Tree bark is another component of bat habitat and is generally found on snags that are in transition from hard to soft (Luce).

Townsend's Big-eared Bat

Tigner stated that Townsend's big-eared bats roost on rock surfaces at underground sites rather than in crevices. This species prefers cooler sites than the fringe-tailed myotis (Tigner). Tigner also noted that Townsend's characteristically use underground sites for maternity/nursery roosts, although there are records of them using buildings (one maternity site in the Black Hills). Lewis added that Townsend's bats have been found roosting within human structures in some parts of their range (e.g., Washington), but not elsewhere. They have also been found in abandoned mines, and using crevices on aboveground cliff faces (Tigner). With loss of caves to commercialization, abandoned mines may be used more now than historically (Tigner). In other areas, this species has been known to roost in trees, but this has not been documented in the Black Hills (Tigner). Townsend's are not known to use snags (Lewis).

Tigner provided a great amount of information on Townsend's maternity roosts. This paragraph summarizes his information. There are only four known maternity roosts for Townsend's big-eared bat in the Black Hills. Two are on the Forest, and two are on private land. Maternity roosts tend to be inaccessible to people and potential predators, because they are on vertical rock faces. During the summer, this species can be found roosting on domes of caves, which serve as a heat trap and provide warmer temperatures for pregnant females with high energy requirements. Riparian areas provide abundant prey; thus, maternity roosts are typically found near riparian areas. There are no known maternity roosts for this species in abandoned mines in the Black Hills. Townsend's bats are very susceptible to human disturbance during the active time of year (summer), more so than other species. During the summer they will be found primarily in sites with low levels of disturbance. A site that may be suitable during the winter may not be suitable during the summer due to disturbance, although both maternity roosts and hibernacula are susceptible to disturbance. While micro-site characteristics of maternity roosts are important in site selection, disturbance levels are more important.

According to Tigner, Townsend's bat is a hardy, robust species; because of this, it has been able to exploit other areas for roosting sites, and is able to tolerate colder sites than other species in winter. A typical roost site would be a spacious area in a cave, rather than a small room with low ceilings (although there are exceptions, e.g., places in Jewel Cave). Townsend's hibernate in clusters or groups, rather than individually (Tigner). Lewis stated that when bats go into torpor, their body temperatures can approach 32 degrees, and it takes a lot of energy to raise their temperatures back up. Disturbance in hibernacula over and above natural levels can therefore result in starvation (Lewis). Even with gates, there are still problems with vandalism and enforcement (Lewis). Hibernation sites are a major concern (Tigner).

Tigner indicated that the Townsend's relationship to the forested environment is related primarily to the microclimate of the specific hibernacula. Healthy riparian areas, including shrubs and other plants, are important for this species (Lewis). The subspecies of Townsend's in the eastern part of the country also uses areas with a mosaic of habitats and different age classes, although they do not use edges (Lewis). The mosaic is within and between habitat types (e.g., old and young forests, hayfields). They likely forage for different insects in different areas (Lewis).

This species is not known to move great distances; 20-25 miles is the farthest known distance traveled (Tigner). Recovery of two bands showed movement from Nemo to Sturgis. It is unknown whether there is any interaction between the Black Hills population and the Badlands population, but in Tigner's opinion, it is unlikely. Suitable winter habitat is available in both areas.

Fringe-tailed Myotis

According to Lewis, habitat requirements vary across the fringe-tail's range. The species is found in extreme areas such as Death Valley. In other places, it is tied very closely to ponderosa pine, larger trees, and less-managed forests. It is fairly sensitive to forest management (Lewis). In forested areas, large snags are best for roosting (Lewis). Maternity roosts will almost always be in snags, although there may be limited use of caves in the Black Hills (Lewis).

The fringe-tailed myotis is a year-round resident in the Black Hills (Tigner). Hibernacula have been found both in abandoned mines and natural caves affording protection and a stable microclimate, although they may also be using deep cracks and crevices (Tigner). Fringe-tailed myotis can be found in the Black Hills during the summer, but according to Tigner, they are very difficult to find during winter. Far fewer bats have been found during the winter as compared to the summer. Tigner believes that this species either hibernates in unknown places, or in inaccessible areas. Fringe-tails hibernate individually or in small groups rather than larger groups like the Townsend's (Tigner).

Tigner stated that based on limited information, this species prefers cracks and crevices for roosting, and prefers warmer sites than the Townsend's. He added that this species is also more closely related to the forested environment than other species. During the summer, the fringe-tailed has not been found away from forested areas. There is no known relationship to forest type or condition during the winter period (Tigner).

According to Lewis, fringe-tails use mostly lightning struck snags, or snags with exfoliating bark. They crawl into cracks or under bark, which provide relatively good thermal protection (Lewis). Even in mines, maternity roosts have been found associated with support timbers, so wood apparently provides good thermal insulation (Lewis). The majority of snags will not be suitable for snag roosting species because they will not have the specific feature needed (for example, exfoliating bark, or existing cavity). *Myotis* will use cracks, woodpecker holes, and other cavities in snags (Luce).

According to Tigner, this species is less susceptible to roost disturbance than the Townsend's (e.g., will not leave roost when disturbed). Tigner clarified that there is little literature to support this.

The fringe-tailed is much more opportunistic in selection of maternity roost sites than Townsend's, and appears to accept a wider variety of acceptable sites (Tigner). Maternity roosts have been found in snags (in small numbers), attics of buildings, and in cracks of large boulders (Tigner). Tigner assumed that fringe-tailed myotis do not use underground roosting sites for maternity/nursery roosts; instead, it appears that the immediate microclimate is more important than location in site selection. Fringe-tails have been known to use the same roost sites successfully year after year (Tigner).

Males are quite opportunistic in roost site selection, so Tigner expressed that availability of summer roost sites are not of real concern. Males do not have the thermal requirements of pregnant or lactating females so they are able to roost in locations with a wider variety of conditions. Males typically use sites with lower temperatures, because a lower metabolic rate while roosting requires less energy (Tigner).

Spotted Bat

Spotted bats roost on cliff faces and rock crevices, and potentially other sites. The cliffs in Spearfish Canyon are an example of the types of cliff faces that could provide suitable habitat (Tigner). Cliff faces approximately 75 feet high are the minimum height spotted bats will use (Lewis). According to Tigner, this species has been netted over water sources, although it is unknown whether they are foraging over water or roosting nearby. Based on the literature, spotted bats are associated with rough, rocky terrain, ponderosa pine to scrub pine, and are high-flying bats (Tigner).

Current Condition

According to Luce, the locations of important bat habitats in the Black Hills are still largely unknown. He suggested taking a conservative approach to err on the side of caution. One hundred year events (e.g., flood of 1972) can unexpectedly reduce populations and destroy evidence of recent and historical use (Tigner).

Tigner emphasized that the role of abandoned mines in supporting bat populations in the Black Hills is poorly understood. The number of abandoned mines is decreasing due to natural degradation, and many of the larger mines have never been surveyed (Tigner). Lewis also noted that it is still poorly understood how the transition of bats from caves to mines will affect populations. Relying on abandoned mines to provide bat habitat may not be a good alternative, given the ongoing and inevitable deterioration and collapse (Lewis).

Tigner stated that in the Black Hills, most information on bats has been collected at underground roost sites rather than tree roosts. Tree roosts are typically more difficult to locate and usually require radio-telemetry (Tigner).

According to Tigner, Jewel Cave is very important for bats, particularly for winter hibernacula. It may be the most significant site in the country for Townsend's hibernacula. It also provides maternity roosts for both Townsend's and fringe-tailed. Jewel Cave and the northeast portion of the forest provide very important habitats for bats in general (Tigner).

Tigner stated that several large caves important to bats have been lost to commercial development. Examples are Wonderland Cave (on Forest Service land administered under a special use permit), Sitting Bull Crystal Caverns, and Bethlehem Cave (the latter two are on private land). According to Tigner, there has been a reduction in associated bat populations as a result of loss of these habitats. Such caves are important because larger caves have a wider range of microhabitats (air flow, temperature, humidity) and thus provide suitable conditions to a wider variety of species with different requirements (Tigner).

Luce offered that Bad Luck Cave and Davenport Cave are both gated, and both are used as hibernacula. Pre- and post-gating surveys of such sites are a critical component in monitoring and management (Luce).

Whitewood Cave is on private property immediately adjacent to Forest Service land. Luce recommended the Forest pursue obtaining this parcel through a land exchange or purchase. According to Luce, Whitewood Cave is a significant maternity and hibernacula site, and is a good, rare example of a single site being used during multiple periods during the year. He also noted that it is still essentially a wild cave although use and exposure (disturbance) is increasing. A much larger population of Townsend's used the cave before increased levels of

recreational activity. This type of use can cause bats to desert a cave in just a couple of years (Luce).

Townsend's Big-eared Bat

Tigner feels habitats are definitely in decline. He indicated that suitable environments are very low in abundance, given the information known regarding maternity roosts. Tigner attributed this to the loss of large caves and closure and crumbling of mines, which has decreased the number of available roost sites in the past 100 years. This assumes abandoned mines play a role in supporting the population (Tigner). Loss of caves and mines, coupled with the characteristically narrow range in selection of suitable habitats (not opportunistic, will not roost in other areas) puts the Townsend's at great risk, in Tigner's opinion. It is unknown whether the decline is attributable to activities on National Forest or private lands (Tigner).

Lewis stated that nearly all Townsend's populations throughout the country show signs of some problems. In his opinion, protecting roosts is the key to protecting the species. Both hibernacula and maternity roosts are most critical to protect. In the southern latitudes, the bats do not go into torpor for as long as they do in the Black Hills, to take advantage of available prey (Lewis).

The subspecies of Townsend's bat that occurs in the Black Hills (Rocky Mountain subspecies, *P.t. pallescens)* is the only subspecies that is not currently listed as Threatened or Endangered (Luce). The eastern limit of this subspecies is in the Badlands (Tigner). Luce believes the Townsend's bat is perhaps in peril, but is not rare by definition. He stated that hypogeal (underground) roosting sites are the limiting factor. In the Black Hills, these sites are primarily caves. Luce recommended that management be maximized to protect known sites. Townsend's is not highly mobile and suitable habitat needs to be available within the home range or there is a risk of losing this species (Luce). Short-term impacts to the prey base may have significant, long-term impacts to the bat. Luce stated that Townsend's are rarely found in non-hypogeal areas, so impacts to habitat may be critical. There are likely to be three or four distinct roost sites within a colony's home range, which should all be identified and managed for the species (Luce).

In Luce's opinion, the only thing keeping Townsend's from being petitioned for listing is that conservation strategies currently address protection. However, if at any point someone feels the conservation strategies are not adequate, then a petition is almost certain. According to Luce, conservation strategies are critical.

Fringe-tailed Myotis

In Tigner's opinion, suitable habitats are broadly distributed, and population abundance is low. There are large gaps in winter habitats, but not summer habitats. The number of hibernation sites has decreased due to closure of abandoned mines, and commercialization of caves (similar to Townsend's).

Tigner's biggest concern is availability of winter roost sites and hibernacula, even though not all sites are known. He stated that they roost in caves and mines, and these features are declining. Maternity roosts are not of concern, because these sites probably have not declined in abundance and they seem to have less rigid requirements to meet (Tigner).

According to Lewis, fringe-tailed bats are doing well in Arizona and New Mexico, but there is a lot of concern for populations in other areas of the West (Lewis).

Spotted Bat

There are no records of spotted bats in the Black Hills. Tigner and Luce do not believe the species occurs in the Black Hills, although Luce suggested that it is not impossible. Lewis felt there might be some suitable habitat in the Black Hills, but if they are here, they should be relatively easy to detect since it would be the only audible bat here. If there are spotted bats here, they have yet to be found. Luce confirmed the species is easily identifiable by sound. Luce has not heard spotted bats during his experience and studies in South Dakota, including surveys with Anabat equipment, which can survey all night without physical monitoring. Priday and Luce (1999) reported new records of spotted bats in Wyoming. None were reported in the Wyoming portion of the Black Hills and Bearlodge Mountains.

Effects of Proposed Activities

Timber Harvest

Tigner felt that Alternative 1 would have a negative effect. He believed the effect could be long-term if, for example, it causes a collapse of a cave or mine. Removing timber at the mouth of a cave or mine that is currently suitable habitat may increase solar exposure and thus internal temperatures and render the habitat unsuitable (Tigner). Improved human access is a long-term effect; noise associated with harvest activity is short-term effect. In Tigner's opinion, increased fuelwood collection resulting from improved human access is a long-term effect, as it would reduce the number of snags available for the fringe-tailed. If snags are created, there may be short- to medium-term effects. Overall, Tigner felt there is likely a medium-term effect. Much of the planned activity over the next five years is in the vicinity of significant bat sites. Effect on the Townsend's big-eared bat and fringe-tailed bat would be widespread over the next five years (Tigner).

In Tigner's opinion, Alternative 2 would cause a positive effect, relative to Alternative 1. Increased snag numbers in Alternative 2 somewhat mitigates effects of increased access, etc. He believed Alternative 2 is positive compared to Alternative 1 in that Alternative 2 specifies larger snags. Tigner noted that larger snags are selected for bat use in part because of thermoregulatory properties. Negative effects like increased fuelwood

collection resulting from increased access would be unchanged from Alternative 1. Tigner was not comfortable selecting an outcome for Alternative 2 when not compared to Alternative 1 (views as continuum of effect). If the Forest Plan were implemented, Alternative 2 effects would be short- to medium-term in duration (rationale similar to Alternative 1). Tigner opinion was that the overall level of effect would be widespread.

Lewis stated that one snag per acre in Alternative 1 is too few snags. He also felt that the increase in snags in Alternative 2 would be a positive effect for the fringe-tailed, especially on south-facing slopes which are preferred for maternity roosts, but also on other slopes. Lewis felt that four to six snags per acre would be even better ("more snags is always better"). According to Lewis, bats do not typically use snags standing in the open; it is better to have snags in clumps, rather than individually. Existing research shows more use in snags that are part of a stand (Lewis).

According to Luce, if the standards in Alternative 2 are implemented, there are fewer opportunities for negative effects than in Alternative 1. However, he felt that the standards could be refined to more effectively mitigate negative impacts. Alternative 2 also provides better protection to foraging habitat than Alternative 1 (Luce).

Luce suggested preventing loss of safety hazard snags during timber harvest by marking a no-cut buffer around them. He also recommended checking available literature on bat use of snags and incorporating relevant information to make snag direction more specific.

In Lewis' opinion, mature forests provide better bat habitat.

Luce suggested that clearcuts and their juxtaposition relative to roosts be addressed. He referenced literature that found bat activity occurred seven to ten times more often in wooded areas as compared to harvested sites.

Tigner recommended against causing changes in solar exposure and air movement patterns adjacent to cave openings by using a buffer. Luce concurred that undesirable temperature variations can quickly be created by wind funnel shifts resulting from harvest activities.

Tigner suggested that Guideline 1401a ("avoid ground disturbance within 100 feet of an opening of a natural cave") be site-specific rather that a standard 100 feet at every site. He suggested the buffer take into account topography, etc. to prevent external changes adjacent to the cave entrance. Short-term effects include noise, dust, and traffic. Tigner stated that if a cave contains a Townsend's roost, a 100-foot buffer might not be adequate. Timber harvest of stands around Erskine and Runkle Caves did not leave an adequate buffer

of untreated trees (Tigner). It was also suggested that Guideline 1401 be a standard rather than a guideline in both alternatives (Tigner).

Lewis suggested enlarging the 100-foot buffer. The Townsend's conservation strategy (Pierson et al. 1999) recommends maintaining a minimum 500-foot horizontal radius around roost entrances. Luce also suggested 100 feet may not be sufficient. Some caves are sinkhole types and therefore have a water cycle that is influenced by vegetation around the mouth of the cave. Luce indicated that ground disturbance and changes in vegetation could affect the wind flow in and around a cave (i.e., how the wind is funneled through adjacent forest affects how a cave breathes). According to Luce, two important criteria in the suitability of caves for bat use are temperature and humidity, both of which can be affected by wind flow and water cycles. Luce also recommended referring to the Townsend's conservation strategy (Pierson et al. 1999) for size of no disturbance buffer.

Tigner suggested that Guideline 3102 ("where caves are important nurseries or hibernacula for sensitive bat species…") apply to other species of bats, not just sensitive species. He also suggested defining or clarifying the criteria for "important" caves. For example, a mine may not have a large number of bats, but may have a large number of species, or a small mine may have a large number of bats (Tigner).

Fuelwood Gathering

Luce felt that fuelwood collection is a much larger threat to snags than timber harvest. He suggested that areas with restrictions on cutting standing dead be identified. The current administrative order prohibiting cutting of standing dead is the best thing the Forest can do right now, for bats and other species, even though it's not popular with the public (Lewis).

Roads and Travel Management

Off-road vehicles may affect bat habitat to the extent that they allow increased access for fuelwood collection and provide increased recreational access to caves and mines (Lewis). He also suggested closing roads accessing caves that have been gated in order to assure compliance with the closure.

According to Tigner, road construction is a concern because it allows improved access to previously inaccessible areas (relative proximity to caves and abandoned mines). Concern is with increased potential for disturbance and increased fuelwood collection (snags for fringe-tailed).

Livestock Grazing

According to Tigner, the effect of Alternative 1 is negative, long-term, and widespread. Items not included in Alternative 2 are of concern to Tigner (e.g., stock pond/tank maintenance), although Alternative 2 is an improvement regarding riparian areas. The amount of improvement is unknown. Alternative 2 effects would also be long-term and widespread (Tigner).

According to Tigner, grazing can cause degradation in riparian zones, including loss of vegetation and reduction in plant species diversity. He stated that these impacts have a negative effect on insect populations and thus are a concern relative to bat foraging habitat. Lewis indicated that the eastern subspecies of Townsend's does not forage over heavily grazed areas. Standards 1302 and 1304 ("do not degrade ground cover… in wetlands," and "relocate or implement mitigation measures for roads, trails, watering tanks…. within the water influence zone") somewhat address concerns regarding riparian areas (Tigner).

Tigner has found that livestock water developments in the Southern Black Hills provide important water sources for a variety of bat species in an area with otherwise minimally available surface water. Lack of maintenance of these water sources is of concern (Tigner). Luce noted that bats obtain water while flying, and availability of open water sources is a critical component of bat habitat. Luce suggested managing spring developments and wetland improvements so bats have access as well as game species (applies primarily to southern Hills). Tigner cited as an example the pond at Log-trough Springs, which is adjacent to Jewel Cave. This pond was constructed for livestock 8-9 years ago, was pretty large and deep, and was used by lots of bats (species and numbers). Now the pond is less than half the original size and much shallower, and bat activity has declined. Another example Tigner cited is Lower Woodcock, where tanks provided a livestock water source. A fringe-tailed maternity roost was nearby as evidenced by capturing pregnant females in mist nets (Tigner). The tanks dried up and bat activity disappeared. Tigner's concern regards lack of maintenance at such sites. He suggested they be maintained annually rather than intermittently.

Mining – Abandoned Mines

Tigner recognized some abandoned mines should be closed for public safety reasons, but recommended it be done in a manner sensitive to bats (e.g., during the time of year bats are not present, not during maternity period). Nothing in the Forest Plan specifically addresses management of abandoned mines, although Standards and Guidelines 3207-3209 address bat habitat. Tigner agreed these are adequate if abandoned mines are included. He suggested that Guideline 3208 ("use seasonal closures for known nursery roosts and hibernacula when there are conflicts with people…") be a

standard. He recommended that Standard 3209 ("close mines or caves…closures shall be designed so that bat movement is not impeded") be a guideline because some mines are quite unstable and present a significant hazard. Tigner felt that even though a mine may provide bat habitat, it will not be available long-term. An example Tigner cited is Goldbug Mine near Horsethief Lake, which is a clear and substantial safety hazard. In this case, he suggested not installing a bat gate because the mine is deteriorating and will collapse soon. He recommended evaluating each site on a case-by-case basis to determine appropriate measures, method, and timing.

Luce suggested that if mine conditions are outside temperature and humidity ranges required by bats, then those sites could be closed. The challenge is that temperature and humidity in many old mines cannot be safely measured due to the instability of the site. If suitable conditions exist or a bat is present, Luce suggested that the site be considered suitable habitat. There is specific information available for managing reclamation sites relative to Townsend's, and Luce believed it can generally be applied to other species. It covers the period when bats are swarming prior to and following hibernacula activity, although Luce indicated that more specifics regarding the periods would be beneficial. It is also important to know what type of habitat (day, night, maternity roost, etc.) the site provides. However, Luce stated, just because a site is a maternity site does not mean it may not have another use, so protection only during maternity period may not be adequate (e.g., males may begin using a site as a night roost when it is not being used as a maternity roost).

For both alternatives, Tigner believes lack of maintenance of abandoned mines would have a negative effect. Duration of effect would be long-term for both alternatives (Tigner).

Tigner suggested that, for both alternatives, terms such as "important" (Standard 3209, "…mines or caves that function as important bat habitat…" and Guideline 3102, "where caves are important nurseries or hibernacula…") and "significant" (Guideline 1401, "for caves which have been determined significant…") be defined in terms of bat use. He also suggested there be consistency among standards. Many are too vague as written now (compare Guidelines 3208 and 3102), (Tigner).

Mining – Current Activity

According to Tigner, mining activity under both alternatives would have a negative, short-term effect during the activity. The effect may be positive, long-term if gating follows activity, or negative, long-term if no improvements follow activity. Most mining activity takes place on private land, so a fairly small percentage of Forest Service land is likely affected (Tigner).

Tigner suggested that Guideline 1516c is vague and recommended it be a standard ("negative recommendations or consent denials will be based on consideration of…habitat of…species identified as needing special management to prevent a need for listing…"). This does not necessarily mean a permit will be denied if bats are present. Consider bat habitat for any permit issued (Tigner).

Tigner noted that Guideline 3102 ("where caves are important nurseries or hibernacula for sensitive bat species…") does not address mining activity and suggested it be a standard. He also noted that Standards 3207 ("Protect known bat roosts and hibernacula during critical periods") and 3209 ("If it is necessary to close mines or caves … closures … designed so that bat movement is not impeded") and Guideline 3208 ("Use seasonal closures for known nursery roosts and hibernacula…") are adequate if they include abandoned mines.

Lewis stated that adding new adits and shafts to a previously abandoned mine generally does not affect bats, as long as old shafts and adits are not closed. A significant threat to bat habitat is converting an old mine with adits and shafts to a strip mine (Lewis).

Noxious Weeds

Tigner thought the direction of effect from the weed control program would be neutral for both alternatives.

Insects and Disease

At a small scale, Lewis felt these activities pose no problems for bats unless they occur adjacent to a roost, but large-scale pesticide application would cause a problem. According to Lewis, spraying for gypsy moths will kill more than just moths; most insects (bat prey) are killed. He noted that bats may forage many miles from roost sites (data shows up to six miles for some bats). Lewis suggested considering an area larger than immediately adjacent to a cave/mine. He recommended referring to Pierson et al. (1999) for more information on this topic. Luce concurred that the effects of spraying in major bat roosting areas can be extremely detrimental to forage species.

Prescribed Fire

Lewis recommended avoiding burning across a cave entrance. He noted that the Townsend's conservation strategy (Pierson et al. 1999) addresses use of fire around cave entrances.

Recreation

Tigner felt Alternative 1 is having a negative effect due to disturbance. He is most concerned with the standard vs. guideline issue and implementation issues. He suggested making Guideline 3208 ("use seasonal closures for known nursery roosts and hibernacula where there are conflicts with people…") a standard, and Standard 3209 ("if it is necessary to close mines or caves…") a guideline. Tigner pointed out that some caves have no controlled access and have very high levels of disturbance. His monitoring indicates that the level and frequency of disturbance is increasing. Alternative 1 may have components to protect these sites, but in Tigner's opinion, they have not been implemented. Caves are crucial to both species, but the vast majority have no protection or means to restrict access during sensitive times of the year (Tigner). There is also no prohibition of habitat-altering activities during non-sensitive periods that can cause impacts during the sensitive period. Although he suggested making Guideline 3208 a standard, he pointed out that, more importantly, Standard 3207 exists ("protect known bat nursery roosts and hibernacula during those critical periods"), but is not being implemented.

According to Tigner, if Standard 3207 regarding cave access were implemented, effects would be short-term. If Standard 3207 is not implemented, effects would be long-term, particularly for Townsend's, but also for bats in general. Tigner felt that recreation, collectively, would have a short-term effect if the Forest Plan were followed. Disturbance is detrimental, but Tigner indicated that bats might come back if disturbance is removed. Bat numbers have increased at Bad Luck Cave. Gating of Safe Investment Mine has resulted in an additional bat species and increased numbers of species than were present before gating (Tigner).

Winter survival and effect of recreational users on caves are of concern, as is availability of roost location information to the public (Tigner). In some cases, recreational use of caves can still be allowed, depending on when bats use the cave (Lewis). Tigner stated that building fires in caves can be devastating to hibernacula and is a common occurrence.

In Tigner's opinion, the overall level of recreation activity is widespread, because caves (significant and otherwise) occur Forest-wide. Bats require disturbance-free sites to hibernate in winter; Townsend's also require disturbance-free sites during the summer (Tigner).

Tigner felt the effects of Alternative 2 would be the same as for Alternative 1, and effects would be long-term and widespread.

Special Uses

For both alternatives, Tigner recommended that the special use permit for Wonderland Cave (and any other permits) be administered according to the Forest Plan. If it were, there would be no concern (Tigner).

Tigner recommended that bats and their needs be considered when implementing Standard 1601 ("provide permits for appropriate prospecting and collection of paleontological resources…"). Mines and caves are popular sites for these activities, which occur primarily during summer. There would be a concern if the site were a Townsend's maternity roost (Tigner).

Overall Effect on Capability to Support Bats

According to Tigner, effects of Alternative 1 would be strongly negative if the Forest Plan continues to be implemented as it has in the past. He stated that lack of implementation of Standard 3207 ("protect known nursery roosts and hibernacula…") is an extremely weak point of Alternative 1. Given what is known about the two species, their colonial nature (both species roost colonially at maternity roosts) and current conditions, it is possible populations of either species may be reduced to where they are no longer viable (Tigner). Where site-specific mitigation measures (according to Alternative 1) have been implemented (e.g., gating of several mines/caves), Tigner noted that habitat conditions have improved somewhat over the last five years. These mitigation measures have been successful in that bats are still present at these sites. Tigner also pointed out that it is possible for a catastrophic event to cause a problem with viability (e.g., fatality in abandoned mine causes panic, many mines closed at wrong time of year, and an entire population of reproducing females could be decimated).

Tigner felt the effects of Alternative 1 would be negative if the Forest Plan were implemented as written. He stated that management (i.e., lack of) is allowing a declining trend in habitats and populations. Lack of management action to protect underground roosting sites is of concern, particularly for Townsend's. Tigner suggested making Guideline 3208 ("use seasonal closures for known nursery roosts and hibernacula…") a standard. He felt it is an extremely weak point of Alternative 1. Guideline 3210 ("provide riparian habitat…") is important, but less important than 3207 and 3208, particularly over the next five years.

Tigner stated that Alternative 2, as written, addresses all components necessary to sustain populations on Forest Service land. He thought the effect of Alternative 2 would be positive if implemented, and would maintain populations to the extent the Forest Service has control over habitat components on National Forest System lands. Alternative 2 provides for snags, underground winter habitat, foraging habitat, and maternity habitat. Both alternatives have protective components for bats and their habitats. The major concern, however, is one of adequate implementation of either alternative (Tigner). He suggested that

surveys of potential and existing hypogeal sites be done prior to management activities.

Luce suggested that Standard 3207 and Guideline 3208 may not adequately address protection of habitat since uses during periods other than maternity and hibernacula periods are not included. For example, if a significant portion of a population is using a site as a night roost and the site is not protected during periods when it is not used as a night roost, the site may not be adequately protected. Luce's concern applies to both alternatives.

Luce also had concerns about Alternative 1, but felt that changing guidelines to standards in Alternative 2 would address the shortfalls in Alternative 1. Luce indicated that components of Alternative 2 at least begin to address possible problems.

In Lewis' opinion, changing guidelines to standards in Alternative 2 would satisfy habitat needs for the Townsend's population, although he thought bats would continue to be lost without gating caves and mines. Lewis also expressed that fringe-tailed bats would likely decrease in relative abundance. Fire suppression (the lack of large-scale fires) and lack of snags may result in continued declines. For these reasons, Lewis believed there probably would not be any increases, but the species would not be entirely lost on the Forest in five years.

INTERVIEW TEAM CONCLUSIONS

All interviewees indicated that Alternative 2 is a large step towards protecting sensitive bat species on the Forest. Alternative 2, with a few minor modifications listed under Phase I Recommendations, contains most of the essential elements that will preserve management options over the next five years. This assumes the alternatives are implemented as written. Implementation has been lacking in some areas in the past. For example, unrestricted access to caves and mines has resulted in negative effects to maternity roosts and hibernacula.

The Townsend's conservation strategy (Pierson et al. 1999) was referenced frequently as the standard by which to manage Townsend's big-eared bats. This strategy was prepared in Idaho, but is applicable in the Black Hills. It is the best information available for managing Townsend's big-eared bats (Lewis).

All three interviewees recommended increasing the distance of the buffer in Guideline 1401a ("avoid ground disturbance within 100 feet of an opening of a natural cave"). The recommended buffer distance is 500 feet, based on the buffer in the Townsend's conservation strategy (Pierson et al. 1999). This would address interviewee concerns about changes in solar exposure, air movements, and temperature variations adjacent to cave and mine openings. Lewis stated that without protection of Townsend's hibernacula, there is a big risk to the species, and

it could be listed. Protection now could prevent listing in the future. Cave and mine protection is the most important for Townsend's.

Lewis recommended avoiding burning across a cave entrance. Guideline 1401 addresses disturbances near caves and is interpreted to include prescribed fire.

Tigner suggested that Guideline 1401 be a standard. This guideline will be treated as a standard in Alternative 2.

Tigner recommended that bats and their needs be considered when implementing Standard 1601 ("provide permits for appropriate prospecting and collection of paleontological resources…"). This currently a part of the permitting process and will be continued.

Snags are more important for the fringe-tailed as maternity roosts are often found there (Lewis). One snag per acre, as prescribed in the Forest Plan, is probably too low. Alternative 2 was seen as an improvement over Alternative 1, with a higher probability of maintaining options over the next five years. Consider continuing the restriction on cutting standing dead trees for fuelwood during the interim period. Reassess in the Phase II Amendment literature on bat use of snags and investigate options for making snag direction more specific to bats. Evaluate other snag-dependant species as well, and balance the needs of all species.

Tigner suggested that Guideline 1516c be a standard ("negative recommendations or consent denials will be based on consideration of…habitat of…species identified as needing special management to prevent a need for listing…"). This guideline is treated as a standard in Alternative 2.

Tigner suggested that surveys of potential and existing hypogeal sites be done prior to management activities.

Tigner noted that Guideline 3102 ("where caves are important nurseries or hibernacula for sensitive bat species…") does not address mining activity and suggested it be a standard. This is included in the Phase I recommendations below. He also noted that Standards 3207 ("Protect known bat nursery roosts and hibernacula during critical periods") and 3209 ("If it is necessary to close mines or caves … closures … designed so that bat movement is not impeded") and Guideline 3208 ("Use seasonal closures for known nursery roosts and hibernacula…") are adequate if they include abandoned mines. They include all features, including abandoned mines, which serve as nursery roosts or hibernacula. Guideline 3208 would be treated as a standard in Alternative 2.

Lewis suggested closing roads accessing caves that have been gated in order to assure compliance with the closure. Standard 9101 ("… roads will remain open … unless a documented decision shows one or more of the following: … motorized use conflicts with Forest Plan objectives, … to prevent unacceptable wildlife conflicts or

habitat degradation …") allows for implementation of road closures to protect caves mines, and other bat habitat if necessary.

A common concern in the interviews was that Forest Plan standards and guidelines have not been adequately implemented. Caves and mines important to bats are not being protected from disturbance due to lack of funds or lack of administration. Examples include not protecting caves where visitors are building fires; not administering permits properly for some mining claims and reclamation; and not properly administering some special use permits such as Wonderland Cave. Tigner suggested that constructed ponds and catchments be maintained in good condition to provide a consistent water source for bats.

Phase I Recommendations

- Guideline 1401a (change buffer distance from 100 to 500 feet): "avoid ground disturbance within 500 feet of an opening of a natural cave".

- Guideline 3102 (change to a standard and encompass all bat species and mines.): "Where caves and mines are important nurseries or hibernacula for bats, protect the caves and mines and their microclimates when designing management activities (e.g., timber harvest, road construction, recreation facilities.)". Apply Guideline 3102 to other species of bats found in the Black Hills, not just sensitive species. The rationale for including other species is that if a site is providing suitable habitat for other species of bats, it may also provide habitat for sensitive bat species. In addition, there are other bats species in the Black Hills for which the interviewees have concerns.

- Modify Standards 3207 and 3208 to include periods other than maternity and hibernation. If these sites are used for day or night roosts during other parts of the year, protect during these periods as well.

- Change Standard 3209 ("close mines or caves…closures shall be designed so that bat movement is not impeded") to a guideline.

- Several existing standards and guidelines contain vague language, including:
    a) Standard 3209 ("…mines or caves that function as important bat habitat"). Define or remove "important".
    b) Guideline 3102 ("where caves are important nurseries or hibernacula…"). Define or remove "important".
    c) Guideline 1401 ("for caves which have been determined significant…"). Define "significant".

- Continue the restriction on cutting of standing dead trees for fuelwood.

- Properly evaluate all abandoned mines as bat habitat prior to closure.

- Work with state and local agencies and groups to identify caves that either currently support, or have historically supported, hibernating bat populations, maternity roosts, and/or other significant bat roosts. The Federal Cave Resource Protection Act of 1988 will be used for guidance in management decisions.

- Improve implementation of standards and guidelines. This applies to all alternatives considered. Improve administration of special use permits, mining claims, mine reclamation, recreation use, etc., to implement guidelines and standards in the Forest Plan or additional standards identified in the Phase I Amendment.

- Survey and monitor maternity roosts and hibernacula on a regular schedule.

- Conduct surveys of potential and existing hypogeal sites prior to management activities.

Phase II Recommendations

- Consider in the Phase II Amendment process, all items listed above in Phase I Recommendations.

- Consider all standards in the Townsend's conservation strategy (Pierson et al. 1999) in developing a Forest strategy for maintaining viable populations.

- In the Phase II Amendment, reassess the literature on bat use of snags and investigate options for making snag direction more specific to bats. Evaluate other snag-dependant species as well, and balance the needs of all species.

SURVEY AND MONITORING METHODS

Lewis recommended abandoned mines be surveyed for bat presence prior to any closure activity. He recognizes this is difficult because there are so many types of mines, there are often multiple entry points, and there are different periods during the year they are used by bats. Luce suggested that limitations on surveying abandoned mines by Forest Service personnel due to safety policies could be addressed by contracting the surveys. He also noted that it is best to survey several times to cover all the time-frames it may be used (for hibernacula, maternity roost, day roost, night roost, and transient roost). The Townsend's conservation strategy (Pierson et al. 1999) includes a survey protocol and dates for this species.

Luce noted the importance of tracking where surveys have been conducted so there is identification of abandoned mine sites with and without bat use or suitable habitat.

The Townsend's conservation strategy (Pierson et al. 1999) discusses various aspects of surveys, including winter surveys. Tigner noted there are limitations on hibernacula surveys in detecting population trends, since results may vary based on numerous influences (e.g., weather). Lewis also recommended the Townsend's conservation strategy (Pierson et al. 1999) for inventory and monitoring protocol.

For monitoring Townsend's, Tigner suggested looking at winter counts at Jewel and Bad Luck Cave (gated during hibernation). It is unknown what percentage of the Townsend's population these sites represent. The Townsend's conservation strategy (Pierson et al. 1999) recommends monitoring only every other year to minimize susceptibility to disturbance, but Tigner thought annual monitoring should not cause a problem.

Luce recommended surveying all maternity sites and hibernacula on a regular schedule. He suggested surveying hibernacula every other year. For example, rotate between maternity sites, hibernacula, and out-flight surveys annually. Do not enter or mist net known Townsend's maternity roost sites to monitor them, because the disturbance will likely cause abandonment (Luce, Tigner). Use bat detectors and night vision scopes at the cave entrance instead of entering the cave. Mist netting can be done at night roosts, because the bats at night roosts are not as susceptible to disturbance. According to Tigner, Townsend's are difficult to mist net successfully because they are very acrobatic. They will also be underrepresented using a detector. For monitoring other bat species, use summer mist netting over water sources to compare with previous data (Tigner).

Tigner stated that there are substantial limitations in surveying for and monitoring Townsend's. There are no habitat features that can be monitored for this species (Tigner). The only way to determine if a site functions as hibernacula is to observe presence. Bat presence in late September or early October is a good indicator of hibernacula (Luce). Tigner noted that hibernacula cannot be determined based on droppings because the bats are not feeding during winter. Night roosting cannot be determined from droppings because of their small size. Tigner added that stains on ceiling or walls might indicate historical roosting (e.g., Davenport Cave). Radio-telemetry cannot be used for Townsend's because they go underground (Tigner).

Tigner stated that there are no known sites with large numbers of hibernating fringe-tails, probably because they use cracks and crevices and are therefore difficult to detect. Tigner recommended conducting population surveys for fringe-tailed myotis during the summer. Maternity roosts are used from year to year, but they may move around under certain circumstances, making monitoring more difficult. Doing exit counts can minimize site disturbance, although buildings with multiple exits makes this method more difficult. A visual count may be performed if the roost site is open enough (Tigner).

Many sites used as hibernacula are also used as night roosts, so monitoring during summer would be the single most important tool. This is true of many bats, but is particularly applicable to the fringe-tailed (Tigner).

Anabat echolocation detection surveys can also be done. According to Tigner, anabat analyzes echolocation calls using a computer to examine vocal signatures, and compares them to known recordings. The technology is fairly expensive. He stated that a library of reference bat calls must first be established, since bat calls are not distinct like birds (calls can vary based on location, e.g., over ponds vs. in forests). Furthermore, anabat does not distinguish sex or age class, and does not reveal other important information (netting pregnant females near sunset indicates proximity to maternity roost, lactating females indicates proximity to nursery roost). When anabat is finally fully developed, it will be a useful tool to supplement other survey and monitoring methodology (Tigner).

Most of the available information on survey methodology was written for Townsend's. Luce suggested doing some monitoring of sites that are known not to be hibernacula or maternity sites to determine the level of human disturbance that is occurring. Spot monitoring may be the only way of checking for recreational use initially, and if fire pits or fireworks remnants are found, then it may be time to begin closure activities.

Tigner recommended bat gates be constructed so they allow bat passage without impeding airflow. Maintain caves or mines as they were when bats were present (Tigner).

OTHER MAMMALS

SPECIES:

- Dwarf shrew (*Sorex nanus)*
- Swift Fox (*Vulpes velox)*

EXPERTS:

- Doug Backlund, Biologist/Data Manager, South Dakota Department of Game, Fish and Parks, Pierre, South Dakota
- Gary Beauvais, Ph.D., Wyoming Natural Diversity Database Director, Laramie, Wyoming
- Dave McDonald Ph.D., Associate Professor, University of Wyoming, Laramie, Wyoming
- Jon Sharps, South Dakota Department of Game, Fish, and Parks (Retired), Arizona
- Dan Uresk Ph.D., Project Leader, USFS Rocky Mountain Research Station, Rapid City, South Dakota

INTERVIEW RESULTS

Natural History Summary

Dwarf Shrew

Backlund said that up until 1966, there were only 18 specimens of dwarf shrew known to the scientific world. Then people learned that they could be caught in pitfall traps. Dwarf shrews have been found in abundance on talus slopes in Montana, where researchers thought they were attracted by large quantities of insects (Backlund). Most evidence for shrew habitat points to talus slopes, yet they have been found on the plains surrounding the Black Hills (Backlund).

Uresk was unable to conclude whether the Black Hills has populations of dwarf shrews or not, because sufficient data is not available. No research has been done here. No dwarf shrews have been found in the Black Hills National Forest, but they have been found in adjacent surrounding areas (Uresk). However, based on intensive pitfall trapping at Alzada, Montana, they would be in broad riparian, not steep riparian areas, and in sagebrush habitats (Uresk). Dwarf shrews have not been found in ponderosa pine, which is probably too dry (Uresk). At Alzada, litter appeared to be the most important component (Uresk).

Habitat preferences of the dwarf shrew are largely unknown (Beauvais). Available literature describes habitat as dry alpine, talus slopes, and big ridges with south facing aspects from upper to lower timberline at both lower and higher elevations. In southern Wyoming, anecdotal observations suggest shrews are associated with talus and exposed rubble. These areas produce a high abundance of invertebrates, which are the shrew's primary forage (Beauvais).

Swift Fox

Swift fox are associated with a random mosaic of prairie dog colonies (Sharps). Sharps added that in the Black Hills, there really isn't a concern because there are so few prairie dog towns.

Uresk said that swift fox require a minimum area of 100 mi^2 in a gently rolling grassland area. The population would benefit from the elimination of coyotes, raptors and red fox. Swift fox require late to early plant succession (Uresk).

While Uresk indicated swift fox are generally found among prairie dogs, Backlund indicated this association is not as strong in the area south of the Black Hills. Backlund believes that swift fox are one of several short-grass prairie species that could adapt to living in mixed grass prairie near prairie dog towns. Many of these species are gone now (like mountain plovers) because there are fewer prairie dogs (Backlund). Coyotes are a major predator of swift fox and even red foxes can drive out swift fox (Backlund). Wolves once controlled coyote numbers, and the presence of wolves may have been a factor in allowing swift fox to range more widely than they do now, along with more extensive prairie dog habitat in the more eastern portions of its former range (Backlund).

Current Conditions

Dwarf Shrew

Backlund discussed findings from this area. A dwarf shrew jaw was taken from an owl pellet near Oelrichs and a dead dwarf shrew was found near Fairburn South Dakota. A researcher set pit traps near Cottonwood, South Dakota, (eastern Pennington County), and caught dwarf shrews that were misidentified at first as vagrant shrews. Terri Hildebrand used pitfall traps in the Hell Canyon area but did not capture any dwarf shrews. Backlund trapped for shrews in Bear Gulch, Black Fox, and Spearfish Canyon with no success for dwarf shrews. There are no records on dwarf shrews from anywhere in the Black Hills National Forest. This is quite odd, since most specimens from outside South Dakota are from mountain locations, while all specimens from South Dakota are from plains locations (Backlund).

Beauvais said there are no records of dwarf shrews in the Wyoming portion of the Black Hills. There is one record in Custer County, one in Pennington County, and three records in grasslands around the Black Hills. More information is needed to determine if the Black Hills has dwarf shrew habitat (Beauvais). Existing reports of dwarf shrews

and their habitat vary widely; there is a broad range of habitat descriptions (Beauvais). Dwarf shrews might be a Pleistocene relic in the Black Hills, but not enough is known to say for sure (Beauvais).

McDonald felt that the Black Hills is probably outside the dwarf shrews' normal range of distribution, and thus this species is possibly not amenable to or influenced by management activities. Occurrence in the northern plains/western South Dakota could be a relic (McDonald). The Black Hills is extremely unlikely to be a core population area.

Uresk indicated that the Rocky Mountain Range and Forest Experiment Station has the best data available from this area for the dwarf shrew. The Experiment Station has defined variables such as litter, moisture, and shrubs to be important for the dwarf shrew (MacCracken et al. 1985) (Uresk). Uresk suggested using MacCracken et al. to identify seral stages and plant variables correlated with dwarf shrew occurrences. Uresk said that dwarf shrews were found in riparian areas, moist meadow-like areas, and in the drier big sagebrush/grass habitat.

Swift Fox

The interviewees were united in the understanding that there is very little habitat that would be used by a swift fox population in the Black Hills. The large expanses of open prairie habitat needed by the swift fox occur to some degree in the southern Black Hills area, but not to the extent needed to maintain a population. It was generally believed that the southern Black Hills, and to some degree the northwestern Black Hills, may be suitable transitory habitat if those areas were to remain open.

Backlund said that swift fox are found south near Ardmore, South Dakota, in southern Fall River County. The only swift fox he was aware of on the Black Hills National Forest was a female that was released in Haakon County. This fox found her way to near Custer and stayed a couple of summers. Swift fox can wander great distances. They likely occur on the Forest occasionally, but are unlikely to den or maintain a population on the Forest (Backlund).

Uresk indicated that the Rocky Mountain Range and Forest Experiment Station has much data available from this area for the swift fox. Research documents available include information such as food habits, den site characteristics, breeding and social behavior, distribution, etc. (see Hillman and Sharps 1978, Egoscue 1979, Uresk and Sharps 1986).

McDonald indicated that suitable environments are highly isolated and exist at a very low abundance. There is little evidence for anything but sporadic historical or current occurrence (McDonald). This is consistent with Beauvais's thought that the swift fox is not a Black Hills species, but rather a peripheral species. Habitats are well known and consist of relatively flat areas with almost no timber

(Beauvais). Habitat suitability may have been higher at times in the past in the southern Hills, when logging and fire was heavier in certain areas (Beauvais).

Effects of Proposed Activities

Dwarf Shrew

McDonald stated that there are larger geologic and historic features that influence the species more so than specific or general management activities. For this reason McDonald concluded that the effects of individual management actions would be neutral.

McDonald said the current and proposed alternatives would result in a direction of effect that was clearly more of an improvement than degradation, because standards and guidelines basically conserve status quo (which is why the shrew is still here). The lack of knowledge contributes to neutrality (McDonald). McDonald said that some existing practices could be detrimental, but it is hard to see that compared to other beneficial activities. McDonald felt that the duration of effect would be medium term and the overall level of management activity could be widespread since the range is limited.

Backlund couldn't make any statements on how Forest Service management would affect the dwarf shrew. Some shrews are very susceptible to pesticide impacts. Dwarf shrews appear to be generalists and they eat whatever they can catch (Backlund).

Beauvais felt one would have to impact a large area over a long time to negatively impact shrew.

Swift Fox

Backlund felt that management would not affect the swift fox because there is not much habitat available. There's probably not much chance of establishing swift fox on Black Hill National Forest (Backlund).

John Sharps and Uresk agreed that heavy grazing by livestock would help prairie dog towns expand. Fire and drought conditions will also benefit prairie dog towns (Sharps). Expanding prairie dog towns may help swift fox.

Beauvais said that habitat is marginal on the Forest for swift fox, and that cutting most trees off the southernmost area of Forest may encourage a swift fox to cross the Forest on their way to other suitable areas.

McDonald felt the alternatives would cause an improvement in habitat for the swift fox. Swift fox need open areas. The Forest Plan direction to increase meadows would be more beneficial than anything else that is detrimental (McDonald). McDonald indicated that the duration of effects would be medium term and widespread because there is so little habitat to begin with. Open areas

would not benefit the fox a great deal because it is very doubtful fox would breed on the Forest. McDonald said it is more important to spend money and efforts on other species than this one (e.g., species that are more affected by management on the forest than by natural habitat limitations).

Overall Effect on Capability to Support Species

Dwarf Shrew

McDonald indicated the overall effect on the capability to support the species would be positive.

Beauvais tended toward picking neutral to negative for overall effect on capability to support the species**.**

None of the interviewees felt that existing management practices or those management practices outlined in Alternative 2 would affect the dwarf shrew to any great extent. There were comments that suggested dwarf shrews may be impacted by some individual management activities, however due to the limited information available it was difficult for the interviewees to pinpoint which activities would be detrimental and in which habitats the activities would have the greatest potential of impacting potential populations of dwarf shrews.

Swift Fox

McDonald said that the overall effect on capability to support the swift fox was positive due to a predicted increase in open areas.

The interviewees felt that the proposed alternatives would beneficially impact habitats potentially used by the swift fox. Those interviewed, agreed that there was a very limited amount of habitat on the Black Hills National Forest, however in the southern portions of the Black Hills were that habitat occurs, intensive grazing and tree removal to maintain and expand existing meadow communities would benefit the swift fox.

General

Uresk suggested that black-tailed prairie dog populations be maintained on the Forest.

INTERVIEW TEAM CONCLUSIONS

Based on information gained in the interviews, there is a question regarding the presence of the dwarf shrew on the Black Hills National Forest. It was clear that there have been reports of dwarf shrews in the western South Dakota and habitats in the Black Hills may have the potential to support dwarf shrew populations.

Those interviewed did not feel that proposed activities would reduce the future management options for either the dwarf shrew or the swift fox. While there may be

some activities that cause negative effects to individuals, the overall effect on capability to support the species would be slightly negative to neutral for the dwarf shrew, and positive for the swift fox.

The largest concern expressed in these interviews was the lack of information on the small mammal populations in the Black Hills. Small mammal surveys would be beneficial in that determinations could be made as to whether or not populations of dwarf shrews exist on the Black Hills, and in what habitats these populations exist. This information would be useful in determining future management strategies for the dwarf shrew.

It was evident that the experts interviewed did not believe populations of swift fox exist on the Black Hills. Actions that maintain the open forest habitat in the southern Black Hills would benefit this species by maintaining potential travel corridors between primary habitats used by this species on the plains surrounding the Black Hills.

Phase I Recommendations

There were no immediate recommendations for either the dwarf shrew or the swift fox.

- Maintain existing black-tailed prairie dog colonies on the Forest.

Phase II Recommendations

Because all of the interviewees were uncertain as to whether or not the Black Hills even has a population of dwarf shrews, there were few recommendations for the species. There was a common suggestion among those interviewed to gather further information. Backlund and Beauvais suggested using surveys to determine habitat quantity and quality. Backlund pointed out that there is no need at this point to monitor until dwarf shrew populations have been found on the Forest. Beauvais indicated that a few simple but well-designed surveys could help determine habitat quantity and quality, especially for dwarf shrews. Beauvais also suggested that surveys concentrate not only on potential populations of dwarf shrews, but other small mammals as well. McDonald suggested focusing on metapopulation dynamics, instead of autecological studies (ecological study of a single species).

Backlund said there is good potential to gain information on shrews and other small mammals from pitfall traps. It is hard to monitor a species that is so difficult to catch (Backlund). Backlund suggested using coffee cans for pitfall traps (dig hole and put water in can to drown), which are more work than other types of mammal traps. Uresk said that minor species are very expensive to monitor and can be very time consuming. However, once relationships are developed between minor and major species, monitoring is cost effective, reliable and

accurate. Uresk suggested plant seral stages as a good way to monitor these animals, but suggested defining the relationships first.

NORTHERN GOSHAWK

SPECIES:

- Northern Goshawk (*Accipiter gentilis*)

EXPERTS:

- Douglas A. "Sandy" Boyce, Ph.D., Deputy Program Manager, USFS Pacific Northwest Research Station, La Grande, Oregon
- Richard Reynolds, Ph.D., Research Wildlife Biologist, USFS Rocky Mountain Research Station, Fort Collins, Colorado
- John Squires, Ph.D., Research Biologist, University of Montana, Forestry Sciences Lab, Missoula, Montana

INTERVIEW RESULTS

Natural History Summary

Prey composition is an integral part of goshawk management (Reynolds). There is limited information on prey use in the Black Hills. Reynolds and Boyce indicated that goshawks in the Black Hills likely prey on American robins (*Turdus migratorius*), black-headed grosbeaks (*Pheucticus melanocephalus*), evening grosbeaks (*Coccothraustes vespertinus*), gray jay (*Perisoreus canadensis*), blue jay (*Cyanocitta cristata*), Clark's nutcracker (*Nucifraga columbiana*), hairy woodpeckers (*Picoides villosus*), long-eared owl (*Asio otus*), mourning dove (*Zenaida macroura*), pinyon jay (*Gymnorhinus cyanocephalus*) in winter, red-naped sapsucker (*Sphyrapicus nuchalis*), and turkey (*Meleagris gallopavo*) polts, as well as those species mentioned in the Forest Plan BA/BE. Flickers, tree squirrels, rabbits, and jays are likely the most important prey species (Reynolds).

Boyce noted that tassel-eared squirrels (*Sciurus aberti*), an important prey item in the Southwestern United States, are absent in the Black Hills, but red squirrels (*Tamiasciurus hudsonicus*) likely substitute for them in goshawk diets in the Black Hills (Reynolds). Squires also noted that red squirrels are probably very important prey items, but further research would be necessary to determine if other species are critical.

Steller's jays (*Cyanocitta stelleri*) are also an important prey item elsewhere that are absent from the Black Hills. Gray jays may fill in for Steller's jays in the Black Hills (Boyce), but they are smaller and less abundant than Steller's jays usually are elsewhere (Reynolds).

The Forest Plan Final EIS BA/BE identified ponderosa pine structural stages 4C and 5 (i.e., dense mature forests and old growth), at least 25 to 30 acres in size, as likely affording the best nesting habitat for goshawks in the Black Hills. Squires confirmed that areas with high canopy closure, big trees, open forest floor, and moderate slopes are most “typical” nest stands. However, he also indicated that goshawks are not restricted to nesting in these stands and could use stands with lower canopy cover as well, such as structural stage 4B. Reynolds cautioned against using habitat data where known goshawks are nesting to extrapolate a definition of good nesting habitat. Goshawks exhibit high site fidelity and may use lower quality habitat but not produce young (Reynolds).

Goshawks will nest in stands of various sizes (Squires). Larger tends to be better, but not at the expense of having suitable nesting habitat distributed across the landscape. It is important to provide nesting habitat across the landscape, outside of known territories.

Current Condition

As is common throughout the West, current stand densities present huge negatives for goshawks and their prey (Reynolds). The density of large trees is low and there was once probably an irregular pattern to the trees (Reynolds). Seed tree cuts and regular spacing during thinning is not good for squirrels and probably some woodpeckers (Reynolds). Goshawk habitat would be better if within-stand diversity was higher (Reynolds), and irregular shaped patches of different ages occurred (Boyce). Reynolds recommended that large stands of a single structural stage (age class) be avoided. Boyce indicated that a good graphic representation of this concept is shown in Pearson (1949) on page 121. Reynolds cautioned that the Black Hills might not fit the Southwest model (Pearson 1949) exactly because the Black Hills fire regime may be different from the Southwest.

The Forest Plan Final EIS BA/BE estimates an average of about 30 nesting pairs of goshawks on the Forest annually, though exact numbers probably vary annually. The 1997 Forest Monitoring Report estimates about 70 territories.

Reynolds estimated there could be close to 300 goshawk territories in the Black Hills if the Kaibab Plateau (Arizona) densities were applied. It is unknown if the Black Hills has the same densities, but it would be appropriate to assume they are, or could be, under the right conditions (Reynolds). Squires also indicated that there might be more goshawks in the Black Hills than are currently known.

Reynolds expressed concerns based on our current knowledge. He did not know the status of Black Hills goshawk populations in relation to the potential population, or what is needed for a viable population. Based on what is currently known about nesting goshawks and their habitat on the Black Hills, and considering that the Black Hills is somewhat isolated, there may not be a viable

population of goshawks (Reynolds). Current data is not adequate to determine population status (Reynolds).

Squires estimated the current condition to be either Outcome B (suitable environments are broadly distributed or of high abundance across the range of the species, but there are temporary gaps) or perhaps Outcome A (suitable environments are broadly distributed and of high abundance across the range of the species). Squires based his decision on the assumption that there are still patches of old forests present in the landscapes as shown on the maps provided. He had some reservations about the Forest Plan's Late Succession Map being detailed enough to make an accurate judgment. Based on the maps, nesting habitat appears well distributed, but patchy, across the landscape.

Effects of Proposed Activities

Timber Harvest

Reynolds and Boyce indicated that Alternative 1 and Alternative 2 would have negative outcomes. Squires also expressed concerns.

Boyce and Reynolds indicated that shelterwood timber harvest methods could cause problems if applied widely. Guideline 2408, part E, in the Forest Plan states that the shelterwood system is the preferred silvicultural system for treating ponderosa pine on suitable lands. Reynolds referenced ten years of data on the North Kaibab Plateau, Arizona where seed tree and seed cuts were widely used. In a demographic study of goshawk territories there, fecundity decreased when seed tree cuts were within one-half mile of goshawk nests (Reynolds). The same effect resulted from fire and windthrow (Reynolds). The more area within one-half mile of a nest that has been altered with seed-tree harvest or affected by fire or windthrow, the fewer young produced (Reynolds). Therefore, managing with a lot of seed tree cuts will be detrimental to goshawks (Reynolds). The work on the North Kaibab Plateau shows seed cuts are detrimental to the food web on which goshawk depend (Reynolds). Unless it can be shown that these cuts produce abundant prey, Reynolds recommended the Forest move away from wide use of these practices. Boyce also noted that applying even-aged management at a scale of a hundred acres could be negative to goshawks.

The problem is that it takes a long time to recover from these treatments (Reynolds). On the North Kaibab Plateau, goshawks stay in a territory even if the prey base is low, and may not reproduce (Reynolds). If harvest continues, mortality might not be replaced with new goshawks. Since the Black Hills is so isolated, juveniles might not move in from other areas (Reynolds).

Squires indicated that thinning might reduce squirrel densities. If squirrels are a critical prey species, the Forest may want to evaluate thinning practices (Squires).

Reynolds was deeply concerned that Alternative 1 and Alternative 2 focus only on 600 acres around known goshawk nests. Squires also noted the lack of a landscape approach to managing goshawk nesting habitat. Squires was concerned that the alternatives do not directly identify spatial distribution and amount of old growth within the range of natural variability. Squires recommended adding language to provide nesting habitat across the landscape, outside of known territories.

Squires thought the snag density objective in the Forest Plan (1.08/ac) is too low. The Southwest goshawk guidelines (Reynolds et al. 1992) recommend three snags per acre in post-fledging areas, and two snags per acre in foraging areas (Squires). Squires also emphasized that snags that are provided be functional for piciforms (woodpeckers). Squires felt that Alternative 2 addressed this concern better than Alternative 1.

If there is a shortage of snags, some can be created, but it is also very important to retain large green trees (Reynolds). The Southwest goshawk guidelines (Reynolds et al. 1992) recognized that some large old trees (>240 years old) were important for recruitment of snags and downed woody material (Reynolds). Reynolds suggested modifying Standard 16 (SNG4) in Alternative 2 to read "…. for the purpose of recruitment of snags and large diameter down woody material". Boyce suggested that the Southwest goshawk guidelines (Reynolds et al. 1992) reserve tree strategy could be applied to seed cuts so that some large trees are never cut. Reynolds also recommended against removing all overstory trees on the final shelterwood cut. There is no guarantee a reserve tree will become a hardened snag, but regardless, the large tree itself is of value (Reynolds and Boyce).

Insect Control

Guidelines 4201 through 4207 show the Forest's strategy for managing insects and diseases.

Insect control can indirectly affect goshawks through reductions in prey. For example, when stands are thinned to manage insects, squirrel habitat may be impacted (Squires). Also, insect control can reduce food for piciforms, which are another important goshawk prey group (Squires). Squires recommended an attempt be made to provide squirrel and piciform habitat across the landscape. According to Parrish et al. (1996) there once were more large (20 inches DBH) old trees in the Black Hills, so there must have been insect outbreaks historically. Squires assumed that, historically, insect outbreaks were an important disturbance process. Alternative 1, Guideline 4206 ("activities should be designed to minimize the risk of spreading the [insect

and disease] infestation while still providing for those wildlife species dependant on the presence of insects and disease") is inadequate without some way to provide squirrel and piciform habitat across the landscape (Squires).

Boyce indicated that gypsy moth suppression could be detrimental to goshawks because *Bacillus thuringiensis* is a non-specific lepicide to moths and butterflies, and may ultimately affect goshawks. However, he also acknowledged that it is not likely that the lepicide treatments would be widespread enough over the next five years to be a problem for northern goshawks.

Mining

Impacts from mining would likely be localized (Squires). As long as mines are not placed in nest stands, the overall affect would be very small (Reynolds). A mine may affect a single pair, but mining is not likely to cause Forest-wide impacts (Squires).

Livestock Grazing

Boyce felt there was not enough information available to evaluate effects of grazing on goshawks. If overgrazing occurs, there could be negative effects, mostly to prey such as cottontail rabbits, thirteen-lined ground squirrels, and possibly ruffed grouse (Boyce and Reynolds). Squires concurred that it likely depends on goshawk prey response to grazing, but he could not address specific issues. Squires noted an attempt to include good grazing management into Alternative 1. As long as good grazing management is practiced, minimal impacts to goshawks would likely occur (Squires). Boyce suggested a longer-term project designed to look at prey species and how they are affected by grazing.

Recreation

Recreation is usually dispersed enough that it does not have impacts unless it occurs in, or very close to, a nest site (Reynolds, Squires). Unless recreation use is extreme, goshawks do not usually abandon nests (Squires). Goshawks generally are not responsive to human voices or people around them. However, if goshawks come off the nest and vocalize, it could keep people in the area longer and have some effect (Reynolds). Timing restrictions on recreation activities could reduce effects during critical periods, but it would depend on site-specific analysis (Boyce). One way to reduce impacts would be to implement road closures or relocate trails if they traverse a goshawk nest stand, at least during April through July. Squires felt the time period in the alternatives (March 1 through September 30) could be shortened to March 1 through the end of August if it facilitates management.

Fire

Boyce thought that the prescribed fire standards and guidelines in the Forest Plan would be beneficial to goshawks. Squires felt that light fires would be acceptable, but stand-replacing fire would not. He recommended that the fire policy mimic the range of natural variability. On the Kaibab Plateau, the more area within one-half mile of a nest that had been altered as a result of fire or windthrow, the fewer young produced (Reynolds).

Fuelwood Gathering

Reynolds noted that fuelwood cutting could be very detrimental to snags and snag dependent species. For further discussion on snags, see the Timber Harvest section above.

Overall Effect on Capability to Support Goshawks

Reynolds and Boyce indicated that Alternative 1 and Alternative 2 would have a negative outcome. Squires indicated that Alternative 2 is much better than Alternative 1 without question. Squires felt the overall effect of Alternative 2 would be neutral to slightly negative. If the Forest is close to 5 percent or less in late succession as the Management Area map indicates, the effect will be more negative (Squires).

A common thread in the interviews was the lack of a landscape approach in providing goshawk habitat well distributed across the Forest (Squires, Reynolds, Boyce). Reynolds was deeply concerned that both alternatives focus only on 600 acres around known goshawk nests. He was concerned that this direction could be keeping the goshawk population artificially low. Because goshawks move around within their territories, they are very difficult to find (Reynolds). There might be more goshawks on the Forest than currently known (Squires). One or two years of goshawk surveys is not enough (Reynolds). Some pairs may not lay eggs for five years (Reynolds). To get confidence in identifying nesting goshawk pairs, four to six years of surveys are needed (Reynolds). If timber harvesting is desired, and good survey data are lacking, it would be important to apply goshawk guidelines of Alternative 2 at the landscape scale (Boyce).

Squires indicated nesting habitat is the most important component of goshawk management. Nesting is what tends to limit distribution and numbers of birds, even though there are foraging requirements as well (Squires). Squires felt Alternative 2 contained a fairly rigorous scheme for known nests, but also noted the lack of a landscape approach to managing goshawk nesting habitat. He was concerned that the alternatives do not directly identify the amount and spatial distribution of old growth in the context of the range of natural variability. Squires

recommended a plan that addresses distribution across the landscape and includes late succession where there are no goshawk records (Squires). Squires thought a couple of large blocks of late succession designated on the Forest did not provide for many goshawks, so he recommended that a better distribution be provided across the landscape (Squires).

Managing a certain percentage of the landscape in different age classes will ensure they are represented across time (Squires). The Forest Plan objective (209) of providing 5 percent of the pine type in the grass/forb stage may be low (Boyce), although this probably does not pose a problem in the next five years (Reynolds). The objective (207) to manage at least 5 percent of the forested land base in late succession may also be too low to support goshawks (Reynolds, Squires). Information suggests that at the time of European settlement, the average tree diameter in the Black Hills was about 20“. This suggests that much of the forest was composed of older trees. It seems that 5 percent of the Forest in mature condition is low and well outside the range of natural variability (Squires). The Southwest goshawk guidelines (Reynolds et al. 1992) recommend 40 percent of the land base be in late succession (VSS 5 & 6, mature to old forest)(Boyce).

In the Southwest, it was found that a balance of structural stages was the best long-term solution for providing prey habitat; otherwise a bottleneck is produced in the other structural stages (Boyce). A balance of structural stages is desired across all forest types except perhaps hardwoods (it may be more important for aspen to be managed for aspen-specific values) (Reynolds). This does not include natural meadows, only forested acres (Reynolds). Reynolds recommended that a balance of structural stages be reflected in a 10-mile radius circle dropped randomly on the Forest. Although Reynolds thought it would be acceptable for structural stages to vary by a few percent, he recommended an overall balance. For goshawks, the earliest and latest structural stages are the most critical (Reynolds).

Reynolds and Boyce recommended creating irregular shaped patches of different sizes and age classes across the landscape. Boyce clarified that within-stand conditions can be even aged; between-stand conditions would be better if uneven aged. Boyce also recommended against managing for large (50 – 60 acres) stands of any single age class (structural stage). In the Southwest, patches of large trees are comprised of 3-44 trees, but a good approach is to leave trees next to large, old stumps, and remove other trees in an effort to mimic natural tree distribution and spacing (Boyce). Boyce indicated that a good graphic representation of this is shown in Pearson (1949) on page 121. Managing for too much of the later structural stages would be detrimental as well, since it would produce a bottleneck just as does managing for too much in the early structural stages (Boyce). The goal is to manage landscapes in patches with variable tree spacing and achieve similar harvest volumes (Boyce).

Boyce noted that Guideline 3.7-2101 in Alternative 1 is well written ("Applicable management activities should replicate natural biological processes found in the areas and strive to replicate natural vegetative patterns and patch size"). He recommended the guideline be applied across the Forest, rather than being limited to less than 5 percent of the Forest (Management Area 3.7), as it is currently intended.

Boyce supported basing our management on the Southwest goshawk guidelines (Reynolds et al. 1992) during the interim period. Squires also indicated that the Southwest guidelines might provide valuable guidance regarding the distribution of age classes. The Southwest goshawk guidelines were produced by an independent team and are recognized as an important management approach (Boyce). The Southwest goshawk guidelines have received documented support from The Wildlife Society (Boyce). Also, available prey in the Black Hills is similar to the Southwest, suggesting the Southwest guidelines are quite applicable (Boyce).

Reynolds suggested the long-term solution is to look at historic conditions and the range of natural variability (tree pattern and distribution) and prey composition. He also recommended that the process used in developing the Southwest goshawk guidelines (Reynolds et al. 1992) be used to develop management guidelines for the Black Hills (Reynolds). Until this is done, there will always be concerns that the Black Hills is different than the Southwest (Reynolds). Information on food habits, including weight and size of food items (Reynolds), is very important to completing the process. Prey remains could be collected at plucking posts to provide this type of information (Reynolds).

The goshawk is an obvious focal species for the Black Hills (Boyce). In managing for goshawks, it would be unknown if all species are being accounted for. However, if habitat conditions move toward those that were present before intensive management, population levels of other species that naturally occur here are more likely to be similar to historic levels (Reynolds).

INTERVIEW TEAM CONCLUSIONS

According to those interviewed, both alternatives lack a landscape approach to goshawk management. Compounding the issue is the fact that the current status of goshawks on the Black Hills is unclear. Managing for only the known goshawk nests and territories would not ensure a viable population. The experts strongly recommended that the Forest incorporate a landscape-scale strategy for managing goshawks during the interim period.

They further recommended that the strategy be based on the Southwest goshawk guidelines. This would include an effort to provide a balance of structural stages across the forested portions of the landscape, not just to the post-fledging areas

around individual nests. This strategy would address Squires' concerns with providing well distributed nesting habitat across the Forest because it would provide for a percentage of the Forest to be in the late successional stage at all times.

The definition of "a balance of structural stages" needs to be defined for the Black Hills. Reynolds and Boyce noted that the balance might be different for the Black Hills than for the southwestern U.S. However, there is little existing information on the range of natural variability to suggest what would be appropriate in the Black Hills. Squires indicated that the Southwest guidelines might provide valuable guidance in defining age class distribution.

According to those interviewed, it is important that the balance of structural stages be applied to conifer cover types. It may be better for hardwood stands and meadows to be managed for their own unique values, as suggested by the experts interviewed.

It may also be desirable to manage spruce stands for their own unique values as well. Managing spruce stands for a balance of structural stages appears to conflict with suggestions received during the American marten (*Martes americana*) interviews (maintain existing spruce). Late successional spruce stands were identified as an important component for the American marten. Spruce stands are a relatively small portion of the forested landscape. Applying the balance of structural stages to spruce stands may reduce options for future marten habitat management. Therefore, it is likely most appropriate for the Forest to apply the balance concept only in ponderosa pine stands during the interim period.

The scientists also recommended that this strategy include a spatial component. They suggested that the Forest avoid managing for large stands of the same structural stage. They indicated it would be better for stands, patches and clumps to be of varying size, shape, and structural stage, in order to replicate natural vegetative patterns and patch size. This strategy seems to conflict with information obtained from the woodpecker interviews. It appears that some woodpeckers require large blocks of mature or old forests.

The snag objective in the Alternative 1 is low for supporting goshawk prey. The snag policy outlined in Alternative 2 is consistent with the Southwest goshawk guidelines (Reynolds et al. 1992), and probably is adequate. The Forest should consider modifying Standard 16 (SNG4) in Alternative 2 concerning large green trees as suggested by Reynolds.

Squires felt that Alternative 1, Guideline 4206 ("activities should be designed to minimize the risk of spreading the [insect and disease] infestation while still providing for those wildlife species dependant on the presence of insects and disease") is inadequate without some way to provide squirrel and piciform habitat across the landscape. The providing a balance of structural stages across the landscape will

likely provide for goshawk prey habitat, including squirrels and woodpeckers. For more information on woodpeckers, see the Woodpecker section of this document.

Other management actions such as recreation and mining were not big concerns as long as goshawk nest stands are protected according to the goshawk standards in Alternative 2. Although grazing may affect some prey species, continuing to follow good grazing practices will likely reduce any potential effects.

For the Phase II Amendment, it would be appropriate for the Forest to use a process similar to the one used to develop the Southwest goshawk guidelines (Reynolds et al. 1992).

Boyce suggested a long-term project to look at the effects of grazing on prey species. This type of study is dependent on funding availability and is not appropriate as a Forest Plan requirement. Therefore, it was not included in the recommendations below.

Phase I Recommendations

- Modify Alternative 2 Standard 10 (GOS3) to read: Design silvicultural prescriptions and management activities to enhance habitat for prey species by maintaining vegetative diversity and striving for a balance of structural stages, from stand initiation to late succession, across the ponderosa pine forested portion of the landscape. Design management activities to attempt to replicate natural vegetative patterns and patch size.

- Modify Alternative 2 Standard 16 (SNG4) to read: During vegetation management activities in ponderosa pine, retain a sufficient number of green trees > 20 inches DBH or from the largest diameter class available, to move towards or maintain an average minimum density of one large green tree per acre within the associated watershed, for the purpose of recruitment of snags and large diameter down woody material.

- Modify Alternative 2 Standard 9 (GOS2) to read: From March 1 through August 31, minimize additional human-caused noise and disruption beyond that occurring at the time of nest initiation (e.g., road traffic, timber harvests, construction activities) within one-fourth mile of all active goshawk nests.

Phase II Recommendations

- Evaluate historic conditions and the range of natural variability (tree pattern and distribution), as well as prey composition. The process used in developing the Southwest goshawk guidelines (Reynolds et al. 1992) should be used to develop management guidelines for the Black Hills (Reynolds). Develop a foraging area strategy for the forest matrix. Use goshawk prey information and historic pattern and structure.

SURVEY AND MONITORING METHODS

Squires recommended surveying areas for a minimum of two to three years, two to three times per year. Even then, only 70 percent of the nests might be found (Squires). Reynolds also noted that two years of surveys is insufficient because some pairs may not lay eggs for five years.

The best time to survey is around the fledging period (Squires). If initial surveys are conducted in habitats representative of the entire Forest (i.e., not just in what is interpreted as the best habitat), defensible data will be produced (Squires). Once this is done, then biased surveys can be conducted in specific habitats with the intent to find the most birds possible.

Surveys do not have to provide 100 percent coverage (Squires). Squires also noted that it would be better to have more people in the field later in the season when goshawks are easier to detect (fledging period) than to have fewer people starting earlier in the year (incubation period) and surveying for a longer season.

Good monitoring requires a commitment (Squires). A preferred approach would use district personnel, possibly in conjunction with university personnel, so people with local knowledge return to the monitoring sites (Squires).

Monitoring goshawks is complex because the true status of an inactive nest site isn't easy to decipher (Squires). Goshawks normally nest near their previous nests, but sometimes they move farther away (Squires). Goshawks are highly mobile, and monitoring should account for that (Squires). If the Forest could monitor a representative sample of nests, and do a quality job, it would likely be in good shape (Squires). It is best to visit an area at least three times per year, and to collect hatching and fledging data (Squires). Squires mentioned Barry Noon as a good contact for monitoring design.

Reynolds noted that large samples of goshawk pairs are needed to describe demographics. The North Kaibab Plateau had five to ten known active nests and another ten to 20 historic nests before research was started there. It took ten years of surveys to get to the current knowledge level of 114 nests (Reynolds). At some point, the Forest will likely need a long-term (five years minimum) research project in the Black Hills to provide a better idea of goshawk population dynamics (Reynolds).

WOODPECKERS

SPECIES:

- Black-backed Woodpecker (*Picoides arcticus*)
- Northern Three-toed Woodpecker (*Picoides tridactylus*)
- Lewis's Woodpecker (*Melanerpes lewis*)

EXPERTS:

- Stanley H. Anderson, Ph.D., Associate Professor, University of Wyoming, Laramie, Wyoming
- Mark Rumble, Ph.D., Research Wildlife Biologist, USFS Rocky Research Station, Rapid City, South Dakota
- Vicki Saab, Ph.D., Research Wildlife Biologist, USFS Rocky Mountain Research Station, Boise, Idaho
- Chris Schultz, Region 2 Partners in Flight Coordinator, USFS San Juan National Forest, Durango, Colorado

INTERVIEW RESULTS

Natural History Summary

Black-backed Woodpecker

The black-backed woodpecker reaches highest abundance in large areas where insects are prolific (e.g., stand-replacement burns and beetle-killed areas) (Anderson, Schultz, Saab). This usually occurs during the first ten years after a fire or beetle outbreak (Schultz). In order to persist on the landscape between these events, the forest matrix must include large stands (hundreds of acres) of old growth or large trees (Anderson, Saab, Schultz). These green areas provide suitable nesting and foraging habitat that maintain a low woodpecker density until an outbreak event or fire promotes the species to higher abundance (Schultz).

In the Black Hills (Rumble) and Idaho (Saab), the black-backed woodpecker occurs in the ponderosa pine cover type. Because the species is associated with spruce/fir forests in other portions of its range, Schultz suggested it is more likely to occur in spruce habitats of the Black Hills. However, Rumble noted that black-backed woodpeckers in the northern Black Hills have been found in pine stands typed as structural stage 3B (i.e., saplings and pole-sized trees with moderate canopy cover), and elsewhere in the Black Hills they have been found in pine 3A (i.e., saplings and pole-sized trees with open canopy cover). Rumble observed

the birds foraging for insects on logs that were felled during timber harvest activities. During winter, Rumble found the species in old growth, two-storied SS 4 and 5 stands that had ponderosa pine regeneration. Anderson agreed that a developed understory is important to the species, but he did not specify seasonal habitat differences, or mention important plant species.

Although it is similar to the three-toed woodpecker in habitat use and rarity, the black-backed woodpecker is tied more closely to, and is more abundant in, conditions created by stand-replacement fire events (Schultz). Saab's research in Idaho showed that black-backed woodpeckers inhabited burned ponderosa pine/Douglas fir stands that had pre-fire conditions of >70 percent canopy closure. Tree size averaged nearly 16 inches DBH, and snag densities were high.

Black-backed woodpeckers are associated with short snags less than 15 feet high, because they prefer to forage relatively close to the forest floor (Schultz). They forage for insects by flicking away the bark on trees (Anderson), and require high densities of beetle-infested trees (Saab). Wood-boring beetles (Saab) and bark beetles (Schultz) are very important year-round food sources, and have a great effect on the woodpecker's abundance, distribution, and long-term viability (Schultz).

The black-backed woodpecker is a permanent resident in the Black Hills, with no seasonal migration in or out of the area (Anderson, Rumble, Schultz). It breeds relatively early; in Idaho, nesting begins in mid-April (Saab).

Northern Three-toed Woodpecker

The three-toed woodpecker is similar to the black-backed woodpecker in that it reaches highest abundance in areas where insects are prolific (i.e., burned and beetle-killed areas) (Anderson, Schultz). However, the three-toed woodpecker is usually much less abundant after stand replacement fires than is the black-backed woodpecker. The best conditions are usually provided during the first ten years after a fire or beetle outbreak (Schultz). In order to persist on the landscape between these events, the forest matrix must include large stands (hundreds of acres) of old growth or large trees (Anderson, Schultz). These green areas provide suitable nesting and foraging habitat to maintain a low woodpecker density until an outbreak event or fire promotes the species to higher abundance (Schultz). In the Black Hills, habitat is provided in the spruce cover type (Schultz, Saab), particularly where a developed understory occurs (Anderson).

Pine beetles and other bark beetles are a very important year-round food source, and have a great effect on the woodpecker's abundance, distribution, and long-term viability (Schultz). Three-toed woodpeckers are a standing-tree bole specialist, and normally use the top third of a tree (Schultz). They are permanent

residents in the Black Hills, and do not seasonally migrate in or out of the area (Anderson, Schultz).

Lewis's Woodpecker

According to Anderson, Lewis's woodpeckers begin colonizing large burned areas within a year after fire, and become fairly abundant within three to four years. Trees must be damaged, and preferably occur in a mosaic pattern with undamaged trees. An example of this is where pre-fire pockets of dead or dying trees flare up during fire. As trees regenerate after fire (approximately 25 years), the birds begin leaving the area and become less common (Anderson). Burned areas provide both nesting and foraging opportunities for Lewis's woodpeckers. The birds forage on insects inside snags and trees, insects that fly, and ants on the ground (Anderson). Good habitat is provided mostly by uncontrolled wildfires, but controlled burns may contribute habitat as well (Anderson). Lewis's woodpeckers sometimes nest communally (Schultz), and their nests are often found close to red-headed woodpeckers (Anderson). Lewis's have high site fidelity, and use the same area year after year (Schultz). They elevationally migrate in spring and fall (Schultz). In Idaho, the birds arrive on their breeding grounds around mid-May (Saab).

According to Saab, pre-fire conditions preferred by Lewis's woodpeckers in Idaho were characterized by moderate (40-70%) canopy closure, 19 inches average tree DBH", and relatively low snag densities (compared to black-backed woodpeckers). In a national account, Lewis's nest trees were described as being >15 inches DBH (Saab citing Dixon and Saab 2000). Saab also indicated that old growth forests provide important habitat for this woodpecker, particularly where canopies are moderately open.

Schultz considered Lewis's woodpeckers to be edge specialists, and nearly obligatory to mid- or late-seral ponderosa pine or cottonwood bottoms. Large diameter snags, spike-topped trees, and weakened green trees are all important to the species (Schultz). Because the bird cannot excavate hard materials, it prefers soft, decayed snags; however, if none are available, pairs may usurp other species from their cavities (e.g., bluebirds, flickers, hairy woodpeckers; Saab). Although snags may be essential, their availability alone does not guarantee use by the species. Stand matrix conditions, such as the availability of spike-topped trees within pine habitats, may be equally influential (Schultz). In cottonwood habitats, large DBH trees are very important, with minimum diameters of 15 to 16 inches (Schultz), and average diameter nearly 45 inches (Saab citing Dixon and Saab 2000).

The experts indicated several areas in the Black Hills currently provide Lewis's woodpecker habitat: Beaver Park/Boundary Gulch burn (Rumble); close to the Forest boundary near Sundance (Anderson); and in cottonwood zones around the perimeter of the Black Hills (Schultz). The cottonwood zones may be very

important winter habitat for altitudinal migrants, and year-round habitat for residents (Schultz).

Current Condition

Black-backed Woodpecker

The black-backed woodpecker is at the southern edge of its range in the Black Hills (Anderson, Saab, Schultz). The species is rare here, as it is across most of its range in the U.S. (Anderson, Saab). Given current habitat conditions, Anderson felt there is probably no danger of losing the species in the Black Hills, despite the bird's rarity. He also thought populations could be enhanced if managed for.

Range-wide, Schultz indicated that Outcome A is appropriate for this species (suitable environments are broadly distributed and of high abundance), as it is doing well in its core range in Canada and Alaska. In the Black Hills, Outcome C is most appropriate (suitable environments are frequently distributed as patches, or they exist at low abundance), due to the distribution of late seral spruce, and to a lesser extent, the distribution of late seral pine.

Northern Three-toed Woodpecker

The three-toed woodpecker is at the southern edge of its range in the Black Hills (Anderson, Schultz). It is seldom reported in the Black Hills (Anderson), but is most likely to use large stands of old growth spruce (Anderson, Schultz). Due to the distribution of late seral spruce (and to a lesser extent, late seral pine), Schultz felt that Outcome C is the most appropriate category for describing the current condition of the species here (suitable environments are frequently distributed as patches, or they exist at low abundance). In a range-wide evaluation, he indicated that Outcome A is most appropriate (suitable environments are broadly distributed and of high abundance), because the bird is doing well in its core range in Canada and Alaska.

Lewis's Woodpecker

Although the Lewis's woodpecker has a broad range, it is very spotty in distribution (Anderson, Schultz). Because of this, Schultz applied Outcome C to the range-wide status of the species (suitable environments are frequently distributed as patches, or they exist at low abundance). Saab thought that there could be more habitat on the Forest for Lewis's woodpecker than the black-backed woodpecker, due to the amount of open, partially cut areas. However, she buffered this statement by pointing out that trees may currently be too small to provide good habitat.

Effects of Proposed Activities

Timber Harvest

Black-backed Woodpecker

Anderson, Rumble and Saab were unified that the black-backed woodpecker requires a higher percentage of old growth than the Forest Plan would provide. Saab further specified old growth that occurs in large, relatively wide blocks of at least 1000 acres are of greatest benefit to black-backed woodpeckers and other cavity nesters. She cited data from Goggans et al. (1988) and Dixon and Saab (2000) that support this recommendation. Rumble offered that old growth that is less clumpy than what occurs in Beaver Park and Sand Creek would be better. Anderson and Schultz stated that if large trees continue to be harvested, a negative impact would probably occur. Saab implied the same when she stated that black-backed woodpeckers rarely use burned areas if they were logged prior to the fire. Effects of logging on this species would be magnified compared to effects on some old growth-associated species, because this woodpecker is very rare (Anderson), particularly between beetle outbreaks (Schultz). Schultz suggested the negative effect would be of medium-term duration compared to other species, because the black-backed woodpecker is not tied quite as closely to the largest snags. In order to aggressively manage for the woodpecker and increase the population, timber harvest would have to be reduced (Anderson), or rotation ages extended (Rumble). Schultz indicated that if the marten/spruce protection guidelines in Alternative 2 were implemented rigorously, a neutral effect would probably occur.

Northern Three-toed Woodpecker

Anderson felt that the percentage of old growth allocated in the Forest Plan is inadequate for the three-toed woodpecker. He and Schultz agreed that if large trees continue to be harvested (as in Alternative 1), a negative impact would probably occur. Effects of logging on three-toed woodpeckers would be magnified compared to effects on some old growth-associated species, because the woodpecker is very rare (Anderson), particularly between beetle outbreaks (Schultz). Schultz suggested the negative effect would be medium-term compared to other snag-dependent species, because the three-toed is not tied quite as closely to the largest snags. Anderson and Schultz expressed that Alternative 2 (with spruce protected for the American marten) would either benefit or have a neutral effect on the three-toed woodpecker, depending on how rigorously the protections were implemented. Saab agreed with them, stating that because three-toed habitat is similar to marten habitat, protecting habitat for the latter species would also benefit the former.

Lewis's Woodpecker

Anderson stated, and Saab implied, that shelterwood treatments could provide habitat for the Lewis's woodpecker because the species prefers relatively open areas. However, Saab recommended strongly that large trees not be harvested. Anderson cautioned that applying shelterwood treatments across the Forest would not effectively manage for Lewis's woodpecker, and that timber harvest is not as effective as fire in creating or maintaining suitable habitat. Clearcuts would be detrimental (Anderson, Saab). Schultz thought timber harvest would have a negative, long-term impact to the woodpecker because large trees (>15 inches DBH) would likely be removed. He emphasized that these large trees create large snags, which are very important. Therefore, he endorsed the snag standards in Alternative 2. He also emphasized it is critical to protect all large snags in areas with high site fidelity by birds, and recommended pre-project surveys be completed. Saab supported the Alternative 2 snag standards, but suggested that 4-6 snags per acre on northeast-facing ponderosa pine slopes would be better than four snags per acre. She also thought it might be better to stratify snag requirements by canopy closure rather than slope (i.e., leave more snags where closure is higher), but thought the slope stratification at least partially accounts for closure. Anderson thought the snag policy would have little affect on the species. Schultz also acknowledged that a well-designed timber harvest that maintains a mid- to late-seral matrix, and provides a good distribution of snags, could result in neutral effects. Saab indicated that if burned areas were partially salvaged, higher Lewis's woodpecker densities would probably occur than if no salvage or total salvage occurred.

Saab specifically stated that managing 5 percent of the Forest as late succession may not be enough for long-term persistence of the Lewis's woodpecker. Although she acknowledged that silviculturally treated stands may be used by Lewis's woodpeckers as long as sufficient large, old trees are available, she was still concerned about the availability of old growth forest.

Fuelwood Gathering

Black-backed Woodpecker and Northern Three-toed Woodpecker

Anderson, Saab, and Schultz agreed that fuelwood gathering, particularly through the removal of snags, negatively affects the black-backed and three-toed woodpeckers. Schultz was particularly concerned about fuelwood harvest in areas where snags are already highly deficient (i.e., <2 per acre in spruce). In those cases, Schultz recommended creating snags and continuing fuelwood harvest restrictions. Saab agreed it is important to protect snags in at least some areas, and added that recruitment over time is another consideration. There are a few important items to consider if snags are to be created or otherwise recruited. First, man-created snags often do not function equally to natural snags (Schultz). Second, it is more desirable that snags and recruitment trees typically be distributed in clumps rather than

individually, because this is the pattern that cavity nesting birds tend to select, and is the pattern most often created by natural processes (Saab).

Lewis's Woodpecker
According to Anderson, snag harvest or retention policies would not affect the Lewis's woodpecker very much. Schultz disagreed with this by stating that a complete ban on fuelwood collection of snags greater than 16 inches DBH is critical in areas where Lewis's woodpeckers demonstrate site fidelity.

Fuels

Black-backed Woodpecker and Northern Three-toed Woodpecker
Landscape level, stand-replacement fires benefit the black-backed, three-toed woodpeckers and other cavity nesting birds by creating snags and causing increases in beetle populations (Saab, Schultz). It is likely these types of fires occurred historically, and Saab recommended the Forest Service at least consider allowing them to occur periodically over time and space (Saab).

Saab commented that the 3 inches minimum diameter of down woody material specified in Forest Plan Objective 212 might be too small. She expressed that species that use down wood, such as cavity nesters and marten, require large logs.

Prescribed Fire

Black-backed Woodpecker
Understory burning typically does not kill large numbers of trees, and therefore may not benefit black-backed woodpeckers or other cavity nesters (Saab).

Lewis's Woodpecker
Prescribed fire can benefit the Lewis's woodpecker. According to Anderson, burns with relatively low mortality rates (i.e., <20%) would be beneficial as long as they are large enough (i.e., hundreds of acres).

Roads and Travel Management

Black-backed Woodpecker and Northern Three-toed Woodpecker
Anderson expressed that the number of roads on the Forest and the amount of off-road travel that occurs presents a negative impact to black-backed and three-toed woodpeckers, at least partially due to increased disturbance of nesting birds. Saab expressed that the high road density in the Black Hills creates a high potential for loss of snags, due to increased access for fuelwood harvest.

Insects and Disease

Insect control efforts may negatively impact woodpeckers (Anderson, Saab, Schultz). Allowing beetle outbreaks to occur in at least some areas (e.g., Forbes Gulch) would be beneficial (Anderson), if not essential (Saab), for long-term persistence of these woodpeckers.

Recreation

Anderson believes where there are people and other animals, disturbance could be a problem. Young birds are often noisy in response to the disturbance, and may attract predators such as marten. Under current management (Alternative 1), high road densities and the allowance of off-road travel contribute to such instances.

Livestock Grazing

Saab stated that grazing does not have much impact on woodpeckers in the short-term, but long-term effects (greater than five years) are not known.

Overall Effect on Capability to Support Species

Black-backed Woodpecker and Northern Three-toed Woodpecker
Anderson stated that under Alternative 1, there would be a neutral to negative overall effect on the black-backed and three-toed woodpeckers, with the most likely scenario being minimally negative. He believes that the combination of human influx, recreation, and timber harvest affects these species. He further stated that if old growth areas are increased, and newly built roads were closed, populations would be maintained or increased. Schultz indicated that under Alternative 1, there would be a negative to strongly negative overall effect on spruce-dependent species such as these woodpeckers. Under Alternative 2, the overall effect would be neutral or slightly negative. Saab stressed that providing late succession forests is very important to maintaining management options for the black-backed woodpecker over the next five years. She also emphasized that on a long-term basis (i.e., greater than five years), large stand replacement fires and beetle outbreaks are very important. She felt the interim direction snag guidelines were reasonable, but she preferred four to six snags per acre.

Lewis's Woodpecker
Anderson thought that the overall effects of the two alternatives are neutral at this point, but with continued application of prescribed fire, positive results could ensue. Schultz stated that although Alternative 2 minimizes negative impacts, and is clearly an improvement over Alternative 1, it would not improve the situation for the woodpecker. Saab stressed that providing late succession forests, and areas with sufficient large trees, are very important for maintaining

management options for the Lewis's woodpecker over the next five years. She also emphasized that on a long-term basis (i.e., greater than five years), large stand replacement fires are very important.

INTERVIEW TEAM CONCLUSIONS

All three woodpecker species are dependent on large trees, large snags, and large areas where insect populations are high. Consequently, it is important that natural processes such as succession to old growth conditions, decay, fire, and beetle outbreaks occur at a landscape scale. Some forest management activities, particularly timber harvest, fuelwood harvest, fire suppression, and insect control, may interrupt these processes or prevent them from occurring. Alternative 1 might not assure that these activities would be performed at a level that would accommodate woodpecker requirements. Alternative 2, with more protective snag standards and provisions for older spruce habitat, is a step in the right direction for woodpecker conservation. However, there are still deficiencies in the arenas of: snag protection from fuelwood harvest and post-fire salvage; the amount, size, and distribution of old growth ponderosa pine forests; and the allowance for catastrophic fire and beetle outbreaks to occur in portions of the Forest.

An administrative order issued by the Forest Supervisor currently bans the harvest of snags for fuelwood. Due to the importance of snags to woodpeckers and other cavity-nesting species, the experts recommended the ban be continued, especially where snags are below threshold densities.

There are no standards or guidelines in either alternative that specifically address post-fire salvage. However, the activity is often conducted when merchantable timber exists. Because fire can create habitat for woodpeckers and other cavity dependent species, it would benefit them to limit or forego salvage in landscapes where habitat is limited.

Schultz emphasized it is critical to protect all large snags in areas with high site fidelity by Lewis's woodpecker, and recommended pre-project surveys be completed. He felt the snag standards in Alternative 2 moved the Forest In the right direction. Guidance on pre-project surveys is included in the interim direction in Alternative 2.

The experts indicated that old growth is important for each of the woodpeckers. Saab expressed immediate concern regarding inadequate old growth allocations in the Forest Plan, indicating action may be necessary during the Phase I Amendment. It is unlikely the Forest will produce more old forests in the next five years. However, the Phase I Amendment can ensure that existing mature and old forests are maintained. This would preserve management options until a more thorough analysis can be conducted during the Phase II Amendment. The analysis should

address the potential for maintaining large blocks of old growth, and determine adequate distribution.

The experts indicated the importance of allowing large scale, stand replacement fires and beetle infestations to occur over space and time. These events are stochastic in nature, and are not only unpredictable, but may have dramatic effects to other species and natural resources. Because the scientists did not define the necessary size or frequency of these events, and immediate negative consequences to species viability are unknown, these issues should be addressed in the Phase II Amendment.

Phase I Recommendations

- Prohibit cutting of standing dead trees.
- Classify spike-topped trees as snags, and retain accordingly.
- Encourage snag distribution in clumps rather than individually.
- Maintain or enhance mature forests, old forests, and large trees over the next five years, or until the Phase II Amendment is completed.
- Consider woodpeckers and other cavity nesting bird species when determining appropriate post-fire salvage treatments.
- Consider woodpeckers and other cavity nesting bird species when determining appropriate treatments in areas where beetle outbreaks have occurred.

Phase II Recommendations

- Consider a strategy that maintains or manages toward blocks of old or mature forest that are at least 1000 acres in size.
- Evaluate travel management direction to address concerns regarding snag harvest and disturbance to wildlife.

SURVEY AND MONITORING METHODS

Saab identified that methods for monitoring snags and large trees can be found in Bate et al. (1999). These methods are relatively new, and are currently being applied in one of her on-going studies.

OTHER BIRDS

SPECIES:

- Fox Sparrow (*Passerella iliaca*)
- Golden-crowned Kinglet (*Regulus calendula*)
- Loggerhead Shrike (*Lanius ludovicianus*)
- Merlin (*Falco columbarius*)
- Olive-sided Flycatcher (*Contopus borealis*)
- Osprey (*Pandion haliaetus*)
- Purple Martin (*Progne subis*)
- Pygmy Nuthatch (*Sitta pygmaea*)
- Upland Sandpiper (*Bartramia longicauda*)

EXPERTS:

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INTERVIEW RESULTS

Natural History Summary

Fox Sparrow

The fox sparrow is a riparian obligate (Schultz). It uses fairly dense shrubby areas of mid- to late-succession, with willows at least five feet tall, and no overstory (Anderson, Schultz). Good habitat is often found where streams leave forested habitats and enter meadows (Anderson). The species rarely uses isolated, small patches of habitat (Saab). Surface water may be required, based on observations from the Rocky Mountains (Schultz). A large ground litter component has also been associated with the species (Saab). The bird nests in

cottonwoods and willows (Anderson), near the ground, or on the ground (Saab). Approximately a dozen subspecies are recognized (Schultz).

Golden-crowned Kinglet

The golden-crowned kinglet is found wherever there is suitable, old spruce (Schultz). In Canada, there are populations from east to west, and in at least some parts of their range, they are abundant. Their prime habitat is mid- to late-seral spruce with large-diameter trees. Although they can be found in pine (Anderson, Schultz), it is likely because individuals were pushed there from nearby saturated populations in spruce habitat (Schultz). They tend to nest high in the canopy of a super-dominant tree, and place their nests out on a limb. They may use deciduous forests during winter (Schultz).

Loggerhead Shrike

According to Rumble, shrike habitat is savannah with ponderosa pine or other tree species. He believed shrub land without a tree component does not provide suitable habitat. For example, when mountain mahogany stands are encroached by pine, they become shrike habitat; however, if the trees are cut, the area reverts to unsuitable habitat. Anderson's definition of shrike habitat was slightly different. He indicated the species is most abundant in brushy areas that are close to hills, open fields, or farming areas. Anderson also stated the shrike is not very abundant in forested habitats. Schultz defined habitat as scattered large shrubs intermixed with open meadows or grasslands. He believed that overall, the matrix is open, with short vegetation structure.

Shrikes often use telephone poles, wires, and fence posts as perches (Anderson). They primarily eat insects such as grasshoppers, and often impale their prey on tree bark.

Merlin

Merlin habitat can be described as where forest meets grassland (Anderson), or where meadows/open pine forest complexes reach at least 100 acres (Schultz). Nests are difficult to find, but a raptor nesting in an old crow, raven, or magpie nest is most likely a merlin (Anderson, Schultz). Merlins exhibit high site fidelity to their nesting area, and will usually return to same nest year after year (Anderson, Schultz). Foraging and nesting habitat are equally important to the species (Schultz), although they are often separate. Foraging habitat is usually away from edges, within the grasslands and their associated riparian stringers (Anderson, Schultz). Merlins prey on horned larks and other sparrow-sized birds, which are probably abundant enough in the Black Hills region to preclude an issue to merlin survival (Schultz). The core range of the subspecies that breeds in the Black Hills is probably the aspen parkland of Canada.

Olive-sided Flycatcher

These flycatchers use snags, spike-topped trees, or old dead branches in trees that occur along edges of conifer forest (Anderson, Schulz). They are often

associated with meadows and riparian areas (Anderson, Schulz), but they have also been observed in shelterwood cuts and dense forests (Anderson). Steep slopes are thought to be a significant habitat feature, particularly in Colorado (Schultz). They forage on flying insects, often "hawking" from a spike-topped tree above the forest canopy (Schultz). They nest in relatively old, large, live trees, generally on the edge of the canopy, opening, or steep slope (Schultz).

Osprey

Osprey are associated with water impoundments, and will often nest on man-made platforms (Anderson).

Purple Martin

The purple martin is typically a plains species. In the Rocky Mountains, it is limited to green aspen stands near open pine parklands and running water (Schultz). They nest in abandoned woodpecker holes and man-made bird boxes (Anderson, Schultz), and feed on flying insects (Anderson).

Pygmy Nuthatch

There was some disagreement among experts on forest cover type and density requirements of the pygmy nuthatch. According to Anderson, the bird prefers dense, old growth spruce, although he acknowledged it would also use other dense conifer forests. Schultz indicated that, at least in Colorado, the bird is more likely to be found in mid- to late- seral, open, park-like stands of ponderosa pine at relatively low elevations. However, the experts did agree that large, old trees are important. Schultz specified trees greater than 19 inches DBH are most beneficial. Good habitat can be described as having large patches of relatively undisturbed forest (in the hundreds of acres; Anderson), and snags distributed throughout (Schultz). The nuthatch tends to select soft, large snags, but is not dependent on creating its own cavities (Schultz). The bird is very mobile, and may travel through open, harvested areas (Anderson). However, nests are typically placed in dense habitats (Anderson). The species forages by flitting from tree to tree, gleaning insects off stems, needles and cones (Anderson). It occurs in the Black Hills during most of the year (Anderson). During winter, they forage over large areas (Anderson), sometimes in flocks (Schultz). Winter survival is a major issue to the species, and exemplifies the importance of large diameter snags that provide roost cavities (Schultz). A winter persistence strategy for the species is communal roosting, whereby many individuals use the same roost (Schultz). Sometimes they are also found feeding or roosting with chickadees, red-breasted nuthatches, and white-breasted nuthatches (Anderson).

Upland Sandpiper

The upland sandpiper breeds in small groups (Schultz). According to Rumble, the sandpiper nests in tall grass (late seral stage), and feeds on insects in short-grass (early seral stage with high invertebrate abundance, similar to prairie dog towns). In addition to requiring an upland component, Anderson indicated that

the species may be tied to, or prefer, areas with some sort of small-stream riparian woodland component.

Current Condition

Fox Sparrow

The fox sparrow is well distributed across North America (Schultz). Although it is extremely abundant in some portions of its range, it tends to occur in lower relative abundance within most suitable habitats (Schultz). Anderson believes there is probably good fox sparrow habitat currently present in the Black Hills, in riparian areas near forest-meadow interfaces. He also implied that current habitat distribution here is similar to historical distribution. Schultz thought, after reading Parrish et al. (1996), habitat has been lost from what was available historically. He assigned Outcome C (suitable environments are frequently distributed as patches, or they exist at low abundance) to reflect current condition in the Black Hills, and Outcome B (suitable environments are either broadly distributed or of high abundance, but with temporary gaps) to characterize the overall range of the species.

Golden-crowned Kinglet

There was discrepancy in opinions about the current condition of the golden-crowned kinglet in the Black Hills. Rumble believes these kinglets are relatively rare in the northern Hills. He observed only eight occurrences in 200 stand samples over two years. Schultz indicated that because the species is widespread and often abundant range-wide, he wouldn't consider it a management priority in the Black Hills. Anderson did not indicate a current condition, but he did state that kinglets are more resilient than other birds discussed here. Schultz assigned Outcome A for the species range-wide (suitable environments are broadly distributed and of high abundance), Outcome B for the northern Hills (suitable environments are either broadly distributed or of high abundance, but with temporary gaps), and Outcome C for the southern Hills (suitable environments are frequently distributed as patches, or they exist at low abundance). The progressively lower ratings for the Black Hills reflect the disjunct spruce distribution along drainages.

Loggerhead Shrike

Rumble thought that suitable shrike habitat in the Black Hills probably occurs where pine trees are encroaching into the larger prairies such as Reynolds Prairie, the Bald Hills, and some mixed-prairie areas in the southern Hills. Schultz agreed that only small, isolated areas of habitat are available in the Black Hills (Outcome C: suitable environments are frequently distributed as patches, or they exist at low abundance), and because of that, he questioned whether the species is or could be viable here. Both Anderson and Schultz stated that the species is not common in the Black Hills like it is in other portions of its range such as Utah, Colorado, and Nebraska. Anderson and Schultz also mentioned that Breeding Bird Survey results have indicated a noticeable decline of the

species over a national or continental scale. Schultz recommended the Forest review national and regional data from the North American Breeding Bird Survey when they become available on the internet (probably within the next year).

Merlin

Merlins are a relatively rare raptor (Anderson, Schultz), and could be petitioned for listing in the future (Anderson). In our area, they are found along the edge of the Black Hills in open habitats (Anderson, Schultz), but not on the drier sites (Anderson). Rumble and Schultz both expressed that habitat is probably best in the southern Hills (e.g., near Edgemont). However, Schultz thought that the Black Hills is far too small a landscape for the merlin, and that if the bird does breed here, it would occur in very low abundance. He elaborated that the Black Hills is periphery range for the merlin, and that immigration from surrounding areas would be necessary to maintain a population (i.e., the population is not viable in the Black Hills). Because habitat gaps are not a barrier to the distribution of this highly mobile species, and because the trends for the prairie subspecies and its habitat are stable, Schultz rated the current condition in the Black Hills as Outcome B (suitable environments are either broadly distributed or of high abundance, but with temporary gaps). He gave the same rating when evaluating the bird at a national scale.

Olive-sided Flycatcher

Schultz indicated a significant concern and priority for the olive-sided flycatcher, partly because there is no information on trends or status of this species in the Black Hills. He suggested the Forest review national and regional data from the North American Breeding Bird Survey, which will be available on the internet within a year. Anderson did not indicate alarm, but instead conveyed that the flycatcher probably has relatively good habitat in the Black Hills, due to the bird's affinity for edges with snags or dead branches.

Osprey

According to Forest records, osprey were either rare or absent in the Black Hills before reservoirs were created. Anderson indicated that even if few osprey currently breed here, they could be encouraged to colonize more habitat by erecting nest platforms near waters that contain fish. Anderson also noted that there are four historical, inactive osprey nests near Newcastle, but he did not offer a reason as to why they are no longer active. Schultz indicated that on a range-wide basis, osprey populations are stable or increasing. Although he did not assign a current condition category for the Black Hills, he assigned Outcome B for the range-wide scale (suitable environments are either broadly distributed or of high abundance, but with temporary gaps).

Purple Martin

Schultz noticed that Parrish et al. (1996) suggested the purple martin was more common in the Black Hills historically than today, but the document provides little additional information. This, combined with Schultz's professed unfamiliarity with

the Black Hills, rendered him unable to assign a current condition outcome class for this region. However, he offered that on a range-wide scale, Outcome C is most appropriate (suitable environments are frequently distributed as patches, or they exist at low abundance). This is because in some parts of its range the martin is widespread, yet overall, it tends to have large gaps in occupancy. Anderson stated that because the species prefers plains rather than forests, it is not an appropriate sensitive species on the Forest.

Pygmy Nuthatch

According to Anderson, pygmy nuthatch habitat is fairly isolated and uncommon in the Black Hills, and the species exists at lower densities than red- or white-breasted nuthatches. However, he also felt populations could be higher than known, because people do not often visit their habitat, and the birds are not very conspicuous. Schultz indicated the species nests regularly in the southern Hills, but he was not comfortable assigning a current condition outcome for the Forest. On a range-wide evaluation, Schultz thought that because the species is often abundant, and their distribution can be somewhat limited, Outcome C was best representative (suitable environments are frequently distributed as patches, or they exist at low abundance).

Upland Sandpiper

According to Rumble, bird counts in the Black Hills have revealed sandpipers in the Bald Hills, Reynolds Prairie, and the southern Black Hills. Anderson believes the birds are fairly common here. Schultz felt that because the grasslands are so limited on the Forest, and breeding groups are small and isolated from other populations, the species could disappear. However, he added that if this did occur, it would not affect the range-wide status of the species. Shultz assessed the current condition of the sandpiper on the Black Hills as Outcome C (suitable environments are frequently distributed as patches, or they exist at low abundance), particularly since the range of the species is contracting at a national scale.

Effects of Proposed Activities

Timber Harvest

Fox Sparrow

Logging could create adverse impacts to the fox sparrow, especially if the activity occurred close to streams and caused increased siltation levels (Anderson).

Golden-crowned Kinglet

Schultz and Anderson agreed that timber harvest in spruce could negatively affect the golden-crowned kinglet. Schultz elaborated by saying that, under Alternative 1, with harvest in greater than 10 percent of the spruce cover type, effects would be long-term. If Alternative 2 is interpreted and implemented

rigorously toward the protection of spruce, effects would be beneficial.

Olive-sided Flycatcher
Timber harvest could have both positive and negative effects, depending on the treatment. Anderson thought that because harvests can create edges, which the flycatcher prefers, effects could be beneficial. Schultz was concerned that harvest could result in fewer large diameter pines along habitat interface zones. He also indicated the importance of protecting spiked-topped trees from harvest.

Pygmy Nuthatch
The experts agreed that timber harvest is likely to have a negative impact on the pygmy nuthatch. Rumble and Schultz both assumed there would be a loss of big trees (defined by both as greater than 15 inches DBH), resulting in a long-term impact. Rumble suggested that extending the rotation age is one of the best ways to provide large diameter trees for late-seral and old growth-associated species such as the black-backed woodpecker and pygmy nuthatch. Schultz emphasized that large trees create large snags, which are very important; therefore, he endorsed the snag standards in Alternative 2. However, Schultz also stated that well-designed timber harvests that maintain a mid- to late-seral matrix and a good distribution of snags could result in neutral effects. He emphasized it is critical to maintain currently occupied habitats, because the species does not colonize new areas very readily. Therefore, Schultz recommended that nuthatch surveys be completed before timber is harvested so the needs of the species can be incorporated in the plans. Anderson specifically mentioned that the removal of understory vegetation is included in the negative effects of harvest.

Upland Sandpiper
Logging activities that negatively impact meadows (e.g., road building) could negatively affect the sandpiper (Anderson). However, if timber harvests are used to increase or maintain meadows, effects could be beneficial (Anderson).

General
Anderson recommended leaving snags on the edge of patch cuts rather than in the middle, because they are less susceptible to blowing down at the edge. He also recommended leaving snags in clumps.

Schultz recommended that all raptor nests be protected, even if they are inactive. This applies to merlins and other species. He provided several reasons for doing so. First, inactive nests could be alternate nests that might be used again later. Raptors typically have high site fidelity. Secondly, trees or landscapes that raptors use are significant and not necessarily common. Finally, raptors have demonstrated their sensitivity to human activities.

Hardwood and Meadow Restoration/Retention

Golden-crowned Kinglet

According to Rumble, efforts to regenerate aspen stands and reduce spruce would negatively affect the kinglet. Schultz agreed with this, but indicated that the species may not warrant protection or management on the Black Hills at this time.

Loggerhead Shrike

Rumble stated that if pine tree encroachment were removed from a savanna (as allowed in Guideline 2107), the area would become unusable to shrikes. He clarified that although not enough area would be treated over the next five years to affect the shrike, cumulative treatments over a longer period of time would create an impact. Treatment in mixed-grass meadows, as opposed to wetter, Kentucky blue grass meadows, would yield the greatest effects to the shrike.

Merlin

Current management direction to remove tree encroachment along edges and in meadows is sufficient for merlins (Anderson).

Purple Martin

Schultz offered that in the Rocky Mountains, managing to obtain large diameter aspen for the purple martin is an emphasis. He did not elaborate on the relationship between aspen and martin in the Black Hills.

Fuelwood Gathering

Pygmy Nuthatch

Anderson stated that cutting snags for fuelwood would adversely impact the pygmy nuthatch. He expressed the importance of maintaining the current administrative order that places a restriction on cutting snags. He also asserted that the larger snag definition in Alternative 2 would be more beneficial than the definition in Alternative 1. Schultz agreed with this, and stated a complete ban on harvest of snags greater than 16 inches DBH is critical.

Fuels

Golden-crowned Kinglet

Stand replacement fires would have a detrimental effect to the kinglet (Schultz).

Olive-sided Flycatcher
Management actions that permit stand-replacement fire events would benefit the olive-sided flycatcher, because these events probably initiate population booms (Schultz).

Roads and Travel Management

Pygmy Nuthatch
Schultz indicated that Forest Plan direction on roads and travel access could have a significant impact on snag production and maintenance. Increased access would likely lead to increased harvest of snags for fuelwood, which could negatively affect the pygmy nuthatch.

Upland Sandpiper
Anderson indicated that off-road vehicle use through meadows could be detrimental to upland sandpipers, particularly if grasses are damaged and wet areas are churned-up.

General
Anderson thought that Objective 309, which encourages more roads be constructed than obliterated, could be detrimental to birds in general. Higher road density leads to increased vehicle access, which may result in more birds being disturbed during nesting. For the same reasons, he also had concerns about the Forest's open travel policy, which allows off-road travel.

Livestock Grazing

Fox Sparrow
Heavy grazing in riparian areas could degrade habitat for the fox sparrow (Anderson). The species is very sensitive to the effects of grazing, because removal of escape cover or nest camouflage increases its susceptibility to predation (Saab). Saab's research on fox sparrow showed that fall grazing was best for the species, as long as livestock were removed before woody plants were browsed. She also recommended that a minimum residual stubble height be left after grazing. She was uncertain of the appropriate height for the Black Hills, but mentioned that both 4 and 6 inches could be considered. Anderson indicated that current management is not negatively impacting the species, and provided no further recommendations.

Loggerhead Shrike
Anderson stated that livestock grazing in forested areas does not impact the loggerhead shrike.

Upland Sandpiper
Rumble stated that grazing is necessary to provide upland sandpiper habitat, and can be used to provide a variety of vegetation heights. Grazing different

pastures for different lengths of time could provide foraging habitat. Leaving some pastures ungrazed could provide nesting habitat. A reduction of livestock numbers from current levels may be necessary to achieve the desired effects.

Insects and Disease

Golden-crowned Kinglet

Because the kinglet eats soft-bodied insects rather than hard-bodied insects such as beetles, insect control measures probably would not have much effect on the species (Anderson).

Loggerhead Shrike

According to Anderson, there is some indication (but no proof) that insecticide application is causing a decline in shrike populations at a nation-wide scale. However, he gave no specific evaluation of the Forest's insect control program.

Pygmy Nuthatch

Anderson maintained that insect control could have negative impacts to the pygmy nuthatch, because beetles are included in its diet.

Prescribed Fire

Olive-sided Flycatcher

Prescribed fire can benefit the flycatcher, because the bird prefers edges and snags that are sometimes created by burning (Anderson, Schultz). Meadows created by fire benefit the species as much as natural meadows (Anderson).

Pygmy Nuthatch

If snags were protected, understory burning in ponderosa pine would benefit the pygmy nuthatch (Schultz). Although Anderson did not specifically address prescribed fire, he did mention that understory removal from timber harvest could negatively affect the nuthatch. An extension of logic can be made that fire could have at least short-term negative impacts as well.

Upland Sandpiper

Anderson indicated that fire can create adverse impacts to the sandpiper, but if rapid regrowth of grasses occurs, and encroaching trees are killed, effects can be positive.

Recreation

General

Anderson indicated that recreationists (e.g., four-wheelers, snowmobilers, etc.) might negatively impact birds by disturbing them during nesting.

Mining

Fox Sparrow

Schultz expressed that the effects of mining under Alternative 1 would be minor and local on the fox sparrow, because water quality and quantity are expected to be adequate.

Overall Effect on Capability to Support Species

Fox Sparrow

Anderson and Schultz expressed that compared to historic management, current management of maintaining or improving riparian conditions and increasing willows is benefiting the fox sparrow. Schultz added that any increase in species abundance would be slow. Schultz also stated that, overall, Alternative 2 would be neutral to the fox sparrow. Anderson and Saab agreed this species is good to manage for, because it is sensitive to habitat alterations.

Golden-crowned Kinglet

Anderson indicated that maintenance of older spruce stands, as provided in Alternative 2, would benefit the golden-crowned kinglet. He also expressed that closing roads and ceasing timber harvests would be beneficial. Schultz stated that timber harvest levels expected under Alternative 1 would significantly affect the kinglet, and reduce its viability in the Black Hills. Under Alternative 2, he predicted effects would be neutral or only slightly negative.

Loggerhead Shrike

Presumably because there is very little shrike habitat on the Forest, Anderson questioned why this bird is on the Forest's sensitive species list. He indicated that the Forest would be futile in attempting to manage for it here. Schultz agreed habitat is very limited, but stated that the lack of information on the species precludes further analysis or determinations.

Merlin

Anderson indicated that protection and maintenance of nest sites is very important for merlin, and without knowing where nests are, it is difficult to manage for the species. Schultz added that both active and inactive nests are an important component to the overall viability of the merlin and other raptors.

Olive-sided Flycatcher

Anderson stated that activities currently taking place on the Forest are basically benefiting the flycatcher. He felt that over the next five years, under the current program, the species would maintain themselves at a fairly good level.

Osprey
Although Anderson discussed osprey to some degree, he did not indicate any potential effects from Forest management. However, he did suggest the species could benefit from distributing man-made nest platforms in otherwise suitable habitat.

Purple Martin
Because both the martin and its habitat are naturally rare in the Black Hills, Anderson felt that Forest management would not impact the species. Furthermore, he recommended the bird be dropped from the Forest's sensitive species list.

Pygmy Nuthatch
Anderson stated that Forest management would have a neutral effect on the pygmy nuthatch. If the Forest ceased timber harvests, increased the amount of older stands, and closed roads, populations would increase greatly. Schultz stated that, although Alternative 2 minimizes negative impacts, and is clearly an improvement over Alternative 1, it would not improve the situation for the nuthatch.

Upland Sandpiper
Anderson suggested that access and number of roads set the overall effect on the upland sandpiper in the Black Hills. Rumble indicated livestock grazing is most influential.

INTERVIEW TEAM CONCLUSIONS

Fox Sparrow
Anderson and Schultz indicated that there is potential for grazing and logging to negatively affect the fox sparrow, but that current riparian and grazing guidelines are sufficient to maintain habitat. Saab's research on fox sparrow showed that fall grazing was best for the species, as long as livestock were removed before woody plants were browsed. She also recommended that a minimum residual stubble height be left after grazing (in riparian areas). If current riparian and grazing guidelines are implemented properly, there will likely be adequate residual stubble height and woody plants. No further direction is recommended.

Golden-crowned Kinglet
The experts indicated that kinglet habitat would receive considerable protection under Alternative 2. Rumble expressed concern that aspen management would reduce spruce habitat for the kinglet, but this may not be adequate cause to abandon aspen restoration efforts. Aspen stands provide landscape diversity in the Black Hills, and provide habitat for other wildlife species. Schultz indicated the kinglet is common enough across its range that specific management for the

species probably is not warranted in the Black Hills. This, combined with aspen values, precludes recommendation of further protection measures.

Loggerhead Shrike

The experts indicated there are very few opportunities to manage for or affect the loggerhead shrike in the Black Hills. The only concern was a potential conflict between meadow restoration activities (removal of encroaching trees) and reduction in the shrike's savannah habitat. However, the benefits of meadow restoration greatly outweigh this detriment, because overall, meadow treatments would increase landscape diversity, and serve to maintain or increase habitat for meadow- and grassland-associated species.

Merlin

Forest management is unlikely to affect the merlin, mainly because very little habitat exists in the Black Hills, and the species requires large areas. Notwithstanding, it is possible that individual nests could be impacted. Because the species is rare, and nest fidelity is high, it would be beneficial to protect known nests. Schultz recommended that historical and current nests be protected for all raptors. It appears that the greatest benefit the Forest can provide is maintenance or restoration of meadow and grassland communities. Guideline 2107 provides the impetus to achieve this ("Pine encroachment on areas that have formed over grass and meadow vegetation may be treated to maintain…landscape diversity"), and needs only to be implemented.

Olive-sided Flycatcher

The experts emphasized the importance of snags, large trees, and edge habitat. Although Alternative 2 offers improvements over Alternative 1 in addressing snags and large trees, the experts recommended additions for inclusion in the Phase I Amendment (e.g., leave snags along edges and in clumps). Schultz was also concerned that the Forest Plan contains no language that protects spike-topped trees. However, he was unaware that these trees are classified as snags, and are therefore accounted for in the snag direction.

Osprey

None of the experts identified concerns regarding osprey populations in the Black Hills, mainly because this area is outside of the historic range of the species. However, there are opportunities to promote colonization of recently created habitat (i.e., construct nest platforms at reservoirs). While there are no existing standards or guidelines to encourage this, there is nothing that prevents it, either. This type of project is at the discretion of District Biologists, and would serve to increase wildlife diversity and viewing opportunities in the Black Hills more than it would contribute to species viability.

Purple Martin

The experts indicated there are few or no opportunities to manage for or affect the purple martin in the Black Hills. Schultz stressed the importance of large

diameter aspen in Colorado, but did not specifically apply the relationship to the Black Hills. Existing guidelines (2201 – 2208) to maintain or restore aspen communities would probably accommodate that need. No additional direction is recommended.

Pygmy Nuthatch

The experts indicated that both Alternative 1 and Alternative 2 could result in additional losses of large diameter trees and snags, and could negatively affect the pygmy nuthatch. A specific concern was that the Forest Plan does not guarantee protection of snags from fuelwood harvest. It is well known that snags are frequently targeted as fuelwood, particularly since the existing road network provides good access to most snags.

The experts were also concerned that the number of large diameter live trees would be reduced through timber harvest. This would apply primarily to pine habitats, because spruce habitats would already be protected from harvest in Alternative 2. The interviewees did not state the desired abundance of large live trees for nuthatch habitat. If mature and old forests were well distributed across the landscape, the concern would likely be alleviated. Standard 16 in Alternative 2 requires at least one green tree per acre that is >20 inches DBH be retained to provide snag recruitment. While it is not known if this is sufficient, it will at least partially serve as a way to meet large tree requirements for the nuthatch.

The need for large tracks of old forest for pygmy nuthatches suggests that a strategy is needed in the Phase II amendment to provide these areas.

Upland Sandpiper

The limited distribution of habitat in the Black Hills reduces management opportunities for the sandpiper relative to some other species. However, two activities have potential for negative effects: travel management and livestock grazing. The Forest Plan currently includes direction that addresses both of these concerns. However, proper implementation is of utmost importance. This is especially true for Standard 1304 and Guideline 9108, which are intended to minimize vehicle-caused damage in riparian areas. Guideline 2502, which encourages rotational livestock grazing, could be applied to create a mosaic of vegetation heights in sandpiper habitat, as was suggested by Rumble.

General

Direction to increase road densities and permit off-road travel (e.g., Objective 309, Guideline 9103) could be re-evaluated to address concerns about snag harvest and disturbance to nesting birds.

Phase I Recommendations

Merlin and Other Raptors

- Protect all current and historic raptor nests.

Olive-sided Flycatcher

- Classify spike-topped trees as snags, and retain them accordingly.
- Provide large diameter trees and snags along habitat interface zones.

Pygmy Nuthatch

- Prohibit cutting of standing dead trees for fuelwood.
- Manage mature forests, old forests, and large diameter trees such that they occur well distributed across the landscape.
- Survey for pygmy nuthatches before timber sales are planned in potentially suitable habitat. Manage occupied areas to maintain habitat suitability for the nuthatch.

Upland Sandpiper

- Enforce travel restrictions in riparian areas.

General

- When planning patch cuts, provide snags on the edges of openings rather than in the middle.
- Encourage snag distribution in clumps rather than individually.

Phase II Recommendations

- Evaluate travel management direction to address concerns regarding snag harvest, disturbance to wildlife, and riparian protection.
- Consider a strategy that maintains or manages toward large blocks of old or mature forest.

SURVEY AND MONITORING METHODS

Golden-crowned Kinglet

According to Rumble, a specific plan must be developed and implemented in order to effectively survey golden-crowned kinglets; even then, not much data would be acquired.

Osprey

Anderson suggested osprey could be surveyed and monitored through direct counts.

Other Species

Anderson suggested consulting the new monograms published by the American Academy of Natural Sciences for existing protocols. He offered to help develop a monitoring program for species for which adequate protocols do not exist. Species that lend themselves well to transect surveys could be evaluated for trends using models. Anderson also suggested some birds could be monitored along with the

marten and certain amphibians, as long as sampling is random and spread throughout the Forest.

Schultz stated that the Colorado Bird Observatory has developed monitoring techniques for all of the bird species discussed in this chapter. Transect modifications might be necessary, but overall, Schultz thought the techniques would apply well in the Black Hills. Site-specific (and therefore, costly) techniques would be the best approach for monitoring loggerhead shrike, merlin, osprey, and purple martin, due to the limited amount of habitat available for these species.

REPTILES

SPECIES:

- Black Hills Red-bellied Snake (*Storeria occipitomaculata pahasapae)*
- Milk Snake (*Lampropeltis triangulum)*

EXPERTS:

- Douglas Backlund, Biologist/Data Manager, South Dakota Department of Game, Fish and Parks, Pierre, South Dakota
- Steven Corn Ph.D., Zoologist, Aldo Leopold Wilderness Institute, Missoula, Montana
- Brian E. Smith, Ph.D., Assistant Professor, Black Hills State University, Spearfish, South Dakota

INTERVIEW RESULTS

Natural History Summary

Black Hills Red-bellied Snake

Corn and Backlund said the Black Hills subspecies is an isolated population. The nearest population of red-bellied snakes is near Aberdeen, South Dakota, approximately 300 miles east (Backlund).

Each of the interviewees described habitat for the red-bellied snake as mesic. Smith said that red-bellied snakes need wetlands, riparian habitat, wet ponds and wet meadows. Backlund stated that there is quite a bit of research data on red-bellied snakes over their primary range, but little data is available specific to the Black Hills.

The northern Black Hills likely provides more habitat than other parts of the Black Hills (Backlund). Corn indicated that red-bellied snakes are associated with downed wood and stumps. As roots decay, the tunnels provide good cover (Corn). Red-bellied snakes give live birth, a trait that allows them to live in cool habitats (Backlund).

Several den sites have been found in the Black Hills (Backlund). Smith said that hibernacula consist of fissures in rock, rather than caves. Red-bellied snakes seem to be present in large numbers in a single hole and come out in the fall to bask on rocks (Smith).

Backlund said that red-bellied snakes might feed on snails. Tom Hays (a former Rapid City resident) raised red-bellied snakes caught in the Black Hills and fed them *Oreohelix* spp. Hays had indicated they were a preferred food of red-bellied snake, implying what is good habitat management for snails may be good habitat management for red-bellied snakes (Backlund).

Milk Snake

All of the interviewees said that the milk snake is secretive, and is generally hard to find. Habitats include moist sand or gravel (glaciated areas) (Backlund), and rocky canyons in ponderosa pine (Corn). Milk snakes and rattlesnakes are found in similar habitats, although milk snakes are more common in forested habitats. Corn added that milk snakes are more likely to remain solitary in over-wintering sites than red-bellied snakes or rattlesnakes. Mice and lizards make up the diet of milk snakes (Corn). The subspecies of milk snake in the Black Hills (pale milk snake, *L. t. multistrata*) has intergrades with other subspecies statewide (Backlund).

Current Conditions

Black Hills Red-bellied Snake

Backlund indicated that suitable environments for the red-bellied snake may be frequently distributed as patches but are likely to be of high abundance in the Black Hills. Smith said that suitable environments are either broadly distributed or of high abundance in the Black Hills.

The northern Black Hills are moister, more fire resistant and more likely to have red-bellied snake habitat (Backlund). The red-bellied snake is not rare in good habitats and not in danger of extirpation in the Black Hills (Backlund). The red-bellied snake is reasonably common in the Black Hills (Smith).

Each of the interviewees emphasized the importance of considering the red-bellied snake when making management decisions because it is an isolated subspecies in the Black Hills.

Milk Snake

The interviewees could not select a single current condition for the milk snake because there have been few sightings and there is little data. Backlund and Smith believe they are rare in the Black Hills and suggested documenting sightings to obtain habitat information. Backlund suggested more research in the Black Hills to better understand the milk snake and its habitat requirements. Backlund indicated that this snake is found almost statewide, but in low numbers.

According to Corn, milk snakes would be common in the Black Hills, and speculated there are few records because they are fairly secretive, and hide under rocks and logs.

Effects of Proposed Activities

Timber Harvest

In Backlund's opinion, any management that opens the pine monoculture and allows more diverse communities (including deciduous trees and shrubs, etc.) would improve habitat conditions for the red-bellied snake. However, he also indicated that cable logging of pine slopes with good red-bellied snake habitat would be detrimental.

Backlund's primary concern with regard to timber harvest is the lack of maintenance and enhancement of hardwood communities. One of the biggest problems in the Black Hills is replacement of deciduous trees by pines (caused by timber management and grazing). This has a direct effect on red-bellied snakes. Pine monoculture is not red-bellied snake habitat (Backlund). Backlund recommended that hardwood regeneration treatment areas be protected from grazing. If logging occurs in mature or old forests where red-bellied snakes occur the affect could be long-term. The effect of opening up the forest and trying to convert back to deciduous (if that is feasible) might take five to 20 years to have an effect on increasing snake populations, depending on how near the nearest snake population is (Backlund).

Red-bellied snakes would benefit the most from an increase in large, down woody material. Three-inch diameter material is too small and does not provide much habitat (Corn). Even when it is not decayed it does not hold much moisture, and does not provide mesic habitat the red-bellied snake uses. Corn said harvest that creates more edge, habitat diversity, and openings in the canopy probably is beneficial to snakes; they do not like dense stands. Solar energy and prey populations are typically higher in more open areas than dense areas. Both snakes bask in the sun, so open areas are better. Both are mostly nocturnal, but they will bask in the early morning and late afternoon (Corn).

According to Corn, milk snakes like open and rocky areas, so timber harvests probably do not affect them much. Corn indicated that activities that impact downed wood, snags (source of downed wood), and large stumps with developed roots would have the biggest effect. Steve suggested not removing large downed logs during harvest.

Livestock Grazing

Backlund's impression is that grazing is generally damaging to red-bellied snake habitat. Livestock can over-utilize areas, trample streamside vegetation and reduce the diversity of plants, which in turn reduces the diversity of insects and snails that red-bellied snakes feed on (Backlund). Backlund stated, that based on his observations, livestock have often

trampled suitable red-bellied snake habitat in the Black Hills. He believes that many problems caused by livestock could be prevented with more active management implementation (e.g., fencing, water distribution, etc.).

Corn indicated that grazing does not present problems for these snakes as long as overgrazing or lowered water tables do not result. Severe overgrazing is a problem for most species, but neither of these species occurs much in rangelands (Corn).

Roads/Recreation

Backlund did not see recreation as having a big impact on red-bellied snakes. However, he did say that roads would impact these snakes in a small way, with more snakes run over. Smith recommended against building a road between a hibernacula and a wetland in close proximity. Great numbers of snakes can be killed in the fall and spring during movement to and from den sites (Smith).

Mining

Backlund indicated that mining would affect red-bellied snakes through loss of habitat, but wouldn't affect a large percentage of the habitat. However, the loss is permanent even if it is relatively small.

Noxious Weeds

Backlund felt that management of the Forest's noxious weeds is probably a necessary evil. Allowing non-native species to invade and proliferate would be more detrimental in terms of impact to the habitat (Backlund).

Corn noted that snakes are pretty hardy and resistant to chemicals. He also indicated that neither alternative would have much of an effect on either reptilian species over the next five years.

Smith said that the snakes are not affected much by spraying. Snakes are known to be pretty impervious to chemicals (Smith).

Prescribed Fire

Backlund said that the effect of fire would be short-term and pretty insignificant.

Overall Effect on Capability to Support Reptiles

Black Hills Red-bellied Snake

Backlund felt that over the next five years the overall effect on capability to support the Black Hills red-bellied snake would be neutral if all standards and guidelines were met. Smith felt that protecting known hibernacula was key in protecting this species. Corn indicated that it would be important to maintain or protect large down woody debris (greater than 3 inches diameter). Protecting and providing the downed wood component would provide the mesic habitats needed by red-bellied snakes.

Milk Snake

Backlund indicated that he didn't know enough about the milk snake to provide an overall effect. However, they feed on small mammals. If there are abundant small mammals in the Black Hills and sufficient ground cover to hide under, the milk snake will likely be fine (Backlund).

INTERVIEW TEAM CONCLUSIONS

The experts interviewed felt that retention of large downed woody debris would provide mesic habitats for Black Hills red-bellied snakes and milk snakes. The Forest Plan contains standards and guidelines for the maintenance of this habitat type (e.g., Alternative 1 Guideline 2307 "Leave large woody debris on harvested or thinned sites … to provide habitat for wildlife", Standard 2308 "On conifer-forested sites … retain … 50 linear feet per acre of course woody debris with a minimum diameter of 10 inches …").

In addition to leaving downed woody debris, one expert recommended that the Forest protect known red-bellied snake hibernacula. Avoid building roads, or conducting other activities that create a barrier between red-bellied snake hibernacula and nearby wetlands.

Backlund's primary concern with regard to timber harvest is the lack of maintenance and enhancement of hardwood communities. One of the biggest problems in the Black Hills is replacement of deciduous trees by pines (caused by timber management and grazing). This has a direct effect on red-bellied snakes. The Alternative 1 and 2 contain an objective to increase hardwood communities. Backlund also felt that the overall effect on capability to support the Black Hills red-bellied snake would be neutral if all standards and guidelines were met.

Grazing concerns identified during the interviews can be addressed through implementation of existing Forest Plan standards and guidelines. Backlund noted livestock often tramples that red-bellied snake habitat. He also felt that the overall effect on capability to support the Black Hills red-bellied snake would be neutral if all standards and guidelines were met.

Due to the lack of information on the milk snake in particular, the experts suggested that the Forest undertake an effort to gather further information on the forest as to what habitats this species uses. This information could be gathered by maintaining a database of all sightings, including habitat type and location information.

Phase I Recommendations

- Avoid management activities that create barriers (i.e., open roads) between red-bellied snake hibernacula and wetlands.
- Document all milk snake sightings.
- Document all red-bellied snake hibernacula.

Phase II Recommendations

- Smith suggested that sightings be documented and hibernacula be mapped. He also recommended this information be input into a GIS model to predict habitat.

SURVEY AND MONITORING METHODS

Corn indicated that populations of snakes are so dispersed that monitoring is very difficult and very labor intensive. One method to find milk snakes is to survey from canyon roads from mid-May to mid-June in the evenings (Corn). Red-bellied snakes are not encountered on roads often, so someone with knowledge of snakes could survey most likely habitat. Another technique recommended by Corn is to look for rocky dens, which might be fairly easy to find. Drift fences and funnel traps could also be used, but because these methods are labor intensive, he did not recommended using them for monitoring a single species.

AMPHIBIANS

SPECIES:

- Leopard frog (*Rana pipiens)*
- Tiger salamander (*Ambystoma tigrinum)*

EXPERTS:

- Douglas Backlund, Biologist/Data Manager, South Dakota Department of Game, Fish and Parks, Pierre, South Dakota
- Steven Corn, Ph.D., Zoologist, Aldo Leopold Wilderness Institute, Missoula, Montana
- Brian E. Smith, Ph.D., Assistant Professor, Black Hills State University, Spearfish, South Dakota

INTERVIEW RESULTS

Natural History Summary

Leopard frogs over-winter in permanent water that does not freeze solid (Corn). They migrate to less permanent water to breed. Breeding areas often do not have fish (Corn). Historically, these frogs were most abundant in small ponds and lakes without fish. Leopard frogs use emergent vegetation for protection (Corn).

Loss of beaver ponds has reduced the availability of leopard frog breeding habitat (Corn). With this loss, frogs have moved from beaver ponds into stock ponds. These frogs may have historically occupied streams and associated ponds, but they do not reproduce well in moving water (Corn). Historically, before non-native predatory fish were introduced, predation on leopard frogs may have been limited (Corn). Leopard frogs can co-exist with predatory fish only if the fish are not abundant, and if shallow water is available (Corn). Smith has noticed springs in the Black Hills do not have many leopard frogs, but catchments often have numerous frogs. Larval development is an issue when the water is too cold (Smith), which could explain the lack of frogs at springs.

Tiger salamanders are frequently found in the same habitats as leopard frogs. Salamander habitat is generally drier and does not always include permanent water (Corn). Breeding sites for salamanders include ponds, temporary waters, or any sort of non-flowing system where water is present for six to eight weeks (Corn). They seem to require deep water and have been observed using ponds

lined with bentonite (Smith). It is not likely that they use waters containing predatory fish (Corn).

Adult tiger salamanders spend most of their lives underground, and emerge infrequently, mainly on wet nights (Corn, Smith). They do not excavate their own burrows, but instead use passageways of other small mammals (Smith). They can be often found in prairie dog towns (Corn, Smith).

If habitats are relatively stable, some populations will have larva that never transform but breed as aquatic form (Corn). These types of ponds occur in the southern Black Hills (Smith). At higher elevations (and possibly xeric habitats), it may be beneficial to remain as aquatic breeders rather than contend with winter snowstorms or drought (Corn). The transformation is somewhat plastic and depends on the environment. Most of these populations are mixed; some are terrestrial breeders and others are aquatic (Corn). Smith has also seen petomorphic (partially transformed) tiger salamanders in colder ponds. Sometimes they metamorphose and sometimes they do not; Smith was not sure what triggers metamorphoses. It is difficult to determine the origin of the adults in springs that have adult larvae (Smith).

Research from late 1980's showed concern for salamanders and acid rain (Corn), but generally, populations are thought to be stable. There are some concerns about disease, but there are no data that show a decline (Corn). Habitats of salamanders and leopard frogs are similar (e.g., non-moving water), and historically, beaver ponds, buffalo wallows, or any temporary water of six weeks to two months provided habitat (Corn).

Most herpetologists feel that populations are stable, but they cannot prove it, partly because good monitoring techniques are lacking (Smith).

Current Condition

According to Backlund, the northern leopard frog and tiger salamander are common and widespread in Black Hills. Neither species is restricted to the Black Hills (Backlund). Regardless, there is a great lack of information related to these species (Backlund).

In Smith's opinion, suitable environments for the northern leopard frog are either broadly distributed or of high abundance across the range of the species, but there are temporary gaps. Smith believes there has been some degradation of habitat on the Forest, which could be stemmed or slowed down by fencing off some wetland areas. Smith thought leopard frog populations are basically okay, but they could be improved. He stated that management efforts would be best applied to catchments.

Smith believes that the leopard frog has been reduced from historical abundance, although he stated he has no baseline data. He based this opinion on information provided in Parrish et al. (1996). This publication describes how riparian areas and wetlands have been, and continue to be, reduced, which Smith thought would cause a reduction in leopard frog populations. Although populations are still in reasonably good condition, they have decreased range-wide. The causes of this are unknown (Smith). There are examples where leopard frog populations are stable, then disappear for no apparent reason related to management (Corn). Smith indicated this could occur again. He also said the best way to address the leopard frog is to avoid denigrating its habitat across the Forest.

Smith was uncertain of the current condition of the tiger salamander, but thought populations are probably stable range-wide. He thought that because the species is tied to water, salamander populations have been reduced since European settlement. Corn stated that tiger salamanders are fairly adaptable, and he was not sure why they are a sensitive species. He did notice there are not a lot of records across the Forest, and speculated that perhaps they are not common in the Black Hills.

Corn hesitated to choose an outcome for the leopard frog or tiger salamander saying that he did not have much local knowledge. Corn said he would lean toward Outcome C (suitable environments are frequently distributed as patches or they exist at low abundance), because there seems to have been a large loss of habitat associated with beaver ponds. The Bearlodge Mountains probably have metapopulations (Corn).

Corn expressed that current conditions are similar for the leopard frog and tiger salamander. He added that there might be more salamanders than frogs, because salamanders occur more often in isolated ponds. He indicated more concern for frogs than salamanders.

Effects of Proposed Activities

Timber Harvest

Backlund indicated that if timber management resulted in the forest being turned into a monoculture, there could be a problem. If the Forest were to leave pine in more fireproof areas (e.g., riparian areas, cool north slopes, etc.) but cut elsewhere, timber harvest would not impact amphibians. According to Backlund, the direction of timber management effects would be neutral under Alternative 1.

Corn did not think that timber harvest is very applicable to frogs. Riparian area direction is applicable, but leopard frogs do not use upland forests (Corn). Corn said that clearcut size and other harvest methods would not

have much of an affect on the amphibians. Corn said that wet meadows are potential habitat, and if a water source is nearby, there could be breeding habitats. Staying out of these areas is beneficial (Corn).

Smith was unable to provide information on logging affects to amphibians, but he has seen where soil compaction poses a problem to those species that burrow (e.g., tiger salamander).

Leopard frogs may use areas that do not or barely meet the legal definition of wetlands; therefore, a clear definition of leopard frog habitat is important (Smith). Once suitable wetland habitats have been described through survey and monitoring, National Wetland Inventory maps or other tools could be used to identify and protect additional areas.

Smith felt that roads built on grades increase sedimentation into riparian areas and suggested that roads be kept away from catchments, ponds and riparian areas (Smith). Smith felt there seemed to be a reasonable protection on roadways. Duration of effect is short- to medium-term (Smith).

Overall level of effects would be widespread because a large area is managed for timber (Smith).

Livestock Grazing

In Backlund's opinion, one of the most harmful management activities to amphibians is grazing. Smith agreed, saying the greatest, most uncontrolled damage occurring is resulting from grazing. Backlund, Corn and Smith all indicated grazing livestock in wetland areas potentially adversely impacts leopard frog populations. Backlund said livestock pollute water, cut trails that put silt in ponds, and trample vegetation. Corn and Smith generally supported his views.

Corn also said high levels of grazing and dense populations of salamanders are not a good combination. This has been demonstrated for salamanders after breeding season when larval densities are high. There are no simple answers for managing grazing for amphibians, and what works for frogs may not be necessary for salamanders (Corn).

Corn said the timing of grazing in and around wetland areas could be critical, because livestock potentially can degrade wetlands during spring. Mid-April through the end of May are sensitive times, not only for trampling of egg masses, but also sedimentation; livestock may stir up water, and eggs get covered with silt (Corn). Corn said at stock ponds, nitrification from livestock has been demonstrated to negatively affect tiger salamanders; bacterial outbreaks resulting from eutrophication can kill all salamanders in a pond.

Smith agreed, stating the primary issue with regard to grazing is livestock in riparian areas and small ponds. Protection of ponds is sometimes neglected (Smith). Grazing can cause erosion in riparian areas and ponds, foul water, and destroy vegetation (Smith). He suggests keeping livestock out of these places and watering them with stock tanks. Standard 1304 ("As opportunities arise and need dictates, relocate or implement mitigation measures for roads, trails, watering tanks, and similar facilities currently located within the Water Influence Zone") would be critical for any of the herpetology issues, according to Smith. He suggested wording this standard more specifically to address catchments and ponds along with the riparian area protection. Smith felt the current wording leaves the standard open for interpretation.

Smith suggested increasing the area of catchments that are being fenced off by 1 to 10 percent a year, or whatever can be accomplished reasonably. He also recommended putting stock tanks downhill from catchments, so when a catchment is full, overflow water can be used. This would also keep livestock below catchments (Smith).

Smith recommended that riparian areas be protected from livestock. He has observed areas that have been damaged, and suggested these areas could be improved. He also suggested that as riparian areas recover and expand, it would be beneficial to expand the fences to include the larger area. Denuded spring areas do not have leopard frogs, and they will not re-colonize (Backlund). Ground cover that has been grazed down destroys habitat for adults, and a lack of aquatic vegetation adversely impacts larval frogs (i.e., fish and other predators can more efficiently prey on them) (Backlund).

Corn sited an instance where lands acquired for Wyoming toads had historically been used for livestock grazing and fishing. When the U.S. Fish and Wildlife Service acquired the lands, livestock were removed. Wyoming toads (especially young after metamorphosis) require open areas, and when grazing ceased, a change in the vegetation occurred that was not favorable to the toads. Corn suggested that a similar thing might happen with leopard frogs. He speculated that if vegetation is too high and too dense, juveniles might not do well. Corn acknowledged there is no quantitative data to tell what cover levels are appropriate.

Some level of grazing is probably beneficial to frogs because if a pond is fenced completely, vegetation growth will be prolific. Corn added that increased vegetation height might quickly reduce habitat for leopard frogs. Fairly heavy grazing in fall produces suitable habitat for Wyoming toads (Corn).

Backlund said the direction of grazing effects is degradation. Backlund suggested removing livestock from wetland areas by fencing, lowering stocking rate, or other methods. Reducing stocking rates may not have the

desired effect because fewer livestock may still concentrate in water areas (Backlund). Backlund added that it might be better to control water access by placing tanks outside of fenced areas and protecting riparian habitats.

Backlund indicated that it could take a long time for amphibians to reach historic population levels. Effects are long-term, and although it is not likely the species will be lost from the Black Hills, there could still be a large impact (Backlund). The key seems to be protecting water sources. Amphibians are subject to drought cycles; in drought years, amphibians are often absent, but sites may be re-colonized from other areas (Backlund). Backlund added that if an increasing amount of habitat were rendered unsuitable, the ability of the population to recover after drought cycles would ultimately be lost.

Smith was unsure that changing guidelines to standards in Alternative 2 will have positive impacts on the smaller ponds and catchments, but instead may continue to allow habitat degradation. An example he gave was Alternative 1 Guideline 2508 ("Design and implement activities in management areas to protect and manage the fenced riparian pastures designated in AMPs. As a first choice, design the grazing systems for riparian pastures to feature spring use..."). Breeding occurs in late spring to early summer, and this guideline promotes spring utilization. In addition, it does not address catchments (Smith). Smith said fencing catchments would help prevent degradation. He also suggested keeping livestock out of areas where amphibians breed, and providing tanks at the sites for watering livestock.

Smith indicated the effects of grazing could be long-term, but he was unsure. He based his opinion on the fact that these frogs do not move very far, probably only a few miles, depending upon locations of other ponds. Given that livestock graze approximately 95 percent of the Forest, Smith felt that the overall level of management activity would potentially be widespread.

Recreation

Corn expressed that the main recreation activity that affects frogs is fishing. If a group of ponds exist that currently do not have fish, but stocking is planned, there could be negative effects (Corn). Backlund and Smith supported Corn's concern. Backlund stated that fish stocking causes a negative impact on amphibian populations. He recommended no trout be stocked in ponds where the fish are not already present. Backlund indicated that the new Black Hills Trout Management Plan developed by the South Dakota Game, Fish and Parks Department will address native fish species and their impacts on amphibians. The problem of illegal fish stocking by the public will continue. There are many examples of this problem and the negative effects to other species (Corn). Smith said that fish could quickly eat all prey out of a pond or stream. Non-native fish are a big concern for the leopard frog. Smith has found, on the plains, that when dams are stocked with fish, the fish only

survive one season. The fish eat all the food in the pond and then they die (Smith). Smith indicated that because predaceous fish are present in the Black Hills and are difficult to control, the best amphibian habitat is water catchments without fish. These areas are particularly critical to protect.

Campsites, hunting, and trail use are not a big problem for leopard frogs. Backlund did not think there is much impact on these amphibians from recreation. Some parts of the country have impacts from harvest of amphibians for bait, but not here in the Black Hills (Backlund). Corn said that about the only time off-road travel is a problem is when it occurs across wet meadows and riparian areas. Smith echoed this concern. It is difficult to prevent off-road vehicles from destroying wetlands (Smith). Off-road vehicular traffic, including snow machines, has a potential long-range affect that is potentially widespread.

Mining

Corn said that the main issue related to mining is runoff, because mining runoff is usually highly acidic and full of metals. Backlund indicated that mining could have local but very negative effects on amphibians.

Prescribed Fire And Fire Suppression

Backlund and Smith felt that fire had little to no effect on amphibians or their habitats. In Corn's opinion, maintaining or creating open meadows through the use of prescribed fire would be beneficial as long as it was not done during the breeding season. Corn added that if there were enough water for breeding, an area probably would not burn anyway. There would be no problem with burning upland areas that are associated with migration routes, because leopard frogs do not move across dry upland areas (Corn). Corn said that in the long-term, fire would stimulate growth and create better habitat for prey (insects), but there has not been many studies to support his belief.

Noxious Weed Control

Smith and Corn were concerned about spraying. Corn commented that in relation to weed control efforts, contaminated water is the biggest concern, especially to eggs and juveniles. But there is little direct evidence herbicides affect amphibians. The surfactants in herbicides are highly toxic to aquatic organisms, and most have restrictions about direct application in wetlands.

Overall Effects of Management

Backlund said that over the next five years there would likely be a slightly negative to neutral effect. Conditions may hold steady, but weather and grazing

could be a major factor in amphibian population health (Backlund). Backlund said that a major drought period could have drastic negative effects on amphibians, particularly after being impacted by grazing. In Backlund's opinion, random effects of grazing could cause greater or lesser effects (e.g., livestock may not have found a given amphibian area for years and then find an area attractive and use it heavily).

Corn did not feel that either alternative would have strong effects to leopard frogs or tiger salamanders. Strong effects would occur where there are changes in availability of aquatic habitats (Corn). Corn said that an increase in beaver would increase the water table, and would increase wet meadows. But, he added, nothing presented indicates big increases or decreases to riparian habitat. In Corn's opinion, there are not any real differences between alternatives, and both are relatively neutral.

In Smith's opinion, the Forest will probably still have frogs in five years, but there are opportunities to improve grazing management. If the Forest does not provide adequate protection for water catchments and ponds, populations would likely decline (Smith). He did not know what the outcome would be and could not predict if or when frogs would disappear. Smith's primary concern is wetlands, especially where predatory fish do not occur. In his opinion, the Forest Plan could address these areas more adequately, and protect them from adverse management actions.

INTERVIEW TEAM CONCLUSIONS

Each of the interviewees indicated a difficulty in identifying an existing condition outcome for the two amphibian species, and there were some discrepancies in the existing condition outcomes for the leopard frog. Smith chose Outcome B (suitable environments are broadly distributed or of high abundance across the range of the species, but there are temporary gaps) for the northern leopard frog, noting there has been some degradation of habitat. Corn chose Outcome C (suitable environments are frequently distributed as patches or they exist at low abundance) based upon his understanding of habitat loss associated with riparian areas. These interviewees based their opinions on the fact that leopard frogs are directly tied to riparian areas and wetlands, have been impacted by loss of historic habitat, and are impacted by predatory fish and livestock grazing. All of the interviewees agreed that there is not enough available information on the tiger salamander to accurately predict an outcome for the existing condition.

All of those interviewed seemed primarily concerned with impacts from grazing, but there were also concerns about non-native fish stocking and off-road vehicles. Backlund recommended no trout be stocked in ponds where the fish are not already present. One commonality among recommendations was protection of wet meadows and small water catchments.

Even though the experts made suggestions concerning grazing management, their ratings of the overall effect of management activities ranged from neutral to slightly negative. The strongest negative response came from Smith. He suggested that populations of both amphibians would decline over the next five years if there were not adequate protection for water catchments, ponds, and riparian areas. He suggested modifying Alternative 1 Standard 1304 ("…Relocate or implement mitigation measures for roads, trails, watering tanks, and similar facilities currently located within the water influence zone") to specifically address catchments and ponds along with riparian area protection.

There was some disagreement among those interviewed on the benefits of protecting all ponds and water catchments from grazing as suggested by Smith. This approach has potential risks to amphibians as pointed out by Corn. Based on the interviews, it is unclear whether this approach is desirable. Therefore, it is not included as a recommendation in Phase I. Instead, it is included as a strategy to consider during the Phase II Amendment process.

Phase I Recommendations

- In Alternative 1 Standard 1304, include ponds and water catchments as part of the Water Influence Zone.

- Work with Other State and Federal agencies to address fish stocking in ponds where fish are not already present.

- Monitor amphibian populations to acquire baseline information and establish trends. This will allow detection of any unexplained or unexpected decline in populations, which may suggest changes in management direction.

Phase II Recommendations

- Monitor amphibian populations to acquire baseline information and establish trends.

- Consider a strategy that protects and improves catchment areas and ponds along with riparian areas, wet meadows and springs. Grasslands and wet meadows are important, because they provide migration pathways for leopard frogs. Cutting off these critical pathways could cause frogs to rapidly decline.

SURVEY AND MONITORING METHODS

Each of the interviewees indicated that it is important to monitor population trends of the leopard frog and tiger salamander. Although there were no known protocols suggested, Smith presented a method that would produce useful data over a period of time.

Smith suggested initially surveying all potential habitats to ascertain where amphibians occur, and then monitoring only these locations. Costs of this proposal may be expensive to initiate, but would ultimately decrease. He noted that leopard frogs are a good indicator species and they are fairly easy to monitor.

Smith suggested the Forest identify approximately 100 sites where frogs exist (20 to 25 on each district). Once the sites have been identified, check for presence or absence at one quarter of the sites in the subsequent years (Smith). Abundance could also be monitored at these sites; Smith suggested that categories of abundance be recorded rather than absolute counts. He also suggested that monitoring efforts measure and describe populations such that the information is quantitative and qualitative enough to publish (Smith).

Smith stated that when frogs start disappearing from monitoring locations, it indicates there is a problem. Leopard frogs have natural population fluctuations, and that can cause a difficulty in interpreting data. If an area changes characteristics, and the leopard frog decreases, it is important to record the changes. Changes may be more difficult to judge where ponds are offshoots of streams and fish are present. Smith recommended taking annual photographs.

Tiger salamanders are enigmatic. It might be possible to determine presence by using minnow traps in the spring. Minnow traps must be checked frequently, and positioned so that air is available for the salamanders. A method that can be used to find salamanders on prairie uplands is to shine flashlights down small mammal burrows at night.

Smith indicated it is very important to identify and classify ponds using National Wetland Inventory maps or whatever other means are appropriate. This information can be stored in a database (such as a GIS coverage), and used for monitoring and identification of potential habitats.

BUTTERFLIES

SPECIES:

- Regal Fritillary (*Speyeria idalia*)
- Tawny Crescent (*Phyciodes batesii)*

EXPERTS:

- Doug Backlund, Biologist/Data Manager, Natural Heritage Program, South Dakota Game, Fish and Parks Department, Pierre, South Dakota
- Gary Beauvais, Ph.D., Director, Wyoming Natural Diversity Database, University of Wyoming, Laramie, Wyoming
- Dave McDonald, Ph.D., Assistant Professor, University of Wyoming, Laramie, Wyoming

INTERVIEW RESULTS

Natural History Summary

Regal Fritillary

The regal fritillary is a strong flyer, so it can travel long distances to areas where populations are not established (Backlund). As long as grasslands with violets are present, the butterfly could colonize. The species lays eggs on vegetation near violets.

Tawny Crescent

According to Backlund, the tawny crescent is associated with riparian areas. Although it forages on asters, it is unknown what species of aster, if any, that it prefers. The species lays eggs on the underside of leaves.

Current Condition

Regal Fritillary

Backlund tended toward current condition Outcome B (suitable environments are either broadly distributed or of high abundance, but with temporary gaps). He added that the regal fritillary is typically more eastern in distribution, and has low abundance in the Black Hills. The Black Hills are at the western margin of the butterfly's range, possibly due to increased aridity farther west. The species is much more common in eastern South Dakota and other prairie states to the east. However, tallgrass prairie habitat has severely decreased in these core-range areas, and has caused a decline in the fritillary population.

McDonald reiterated that the regal fritillary is a grassland species with little naturally occurring habitat in the Black Hills, and because of this, the species may periodically disappear and reappear here. He added that this is a common pattern for many butterflies, and suggested that instead of monitoring autecology, it may be more useful to find out if the pattern is natural for the fritillary.

Beauvais stated that although the regal fritillary is primarily a grassland species, it is also found in somewhat disjunct tallgrass prairies in several mountainous areas across the U.S. He believes that the Black Hills is not totally disjunct from the main range, and could be recolonized if the population disappears. He felt Outcome C is most reflective of the current condition (i.e., suitable environments are frequently distributed as patches or they exist at low abundance), due to loss of tallgrass prairies and naturally patchy habitat. He speculated that the regal fritillary distribution within the Black Hills might be related to the moisture gradient between the northern and southern sub-regions. He further stated that the species is rare range-wide because one-half to two-thirds of its original range is now cultivated. This loss of preferred habitat might increase the importance of the Black Hills to the species. Beauvais was unsure why the species is rare even within good habitat, and didn't know if, or how much, management activities affect distribution and abundance.

Tawny Crescent

Backlund cited non-peer reviewed information from Dr. James Scott about the subspecies status of the tawny crescent in the Black Hills. According to Scott, the Black Hills has a disjunct population of the Lakota subspecies, whose main range is in southern Canada. The butterfly appears to be widespread in both areas. There is a different subspecies in the east, and because that subspecies has disappeared from much of its range, the species had candidate status for the Threatened and Endangered Species list. Given this history of decline, Backlund expressed the importance of monitoring the population in the Black Hills.

McDonald expressed that, given the lack of information, and lack of an obvious distribution pattern, it was difficult for him to assess the current condition of the tawny crescent. However, his best guess was that Outcome C is most representative (i.e., suitable environments are frequently distributed as patches, or they exist at low abundance). As he stated for the regal fritillary as well, butterflies often appear and disappear from areas, and instead of being alarmed by this pattern, an investigation could be conducted to determine whether it is natural. McDonald also re-stated that the Forest probably cannot ensure local, regional, or global persistence of either of the Black Hills' sensitive butterfly species.

According to Beauvais, the tawny crescent's preferred habitat (montane, mesic meadows with a conifer component) has decreased in abundance since the Forest was established. The main causes of this are tree encroachment into meadows, and the resultant decrease in available water. Because the Black Hills

are isolated from other areas with tawny crescent habitat, there is potential for genetic isolation. This, combined with the fact that the butterfly's range covers the entire Black Hills, prompted Beauvais to rate the current condition as Outcome C (suitable environments are frequently distributed as patches, or they exist at low abundance). However, when he considered the entire range of the species rather than just the Black Hills, he selected Outcome D (suitable environments are highly isolated, or they exist at very low abundance) as most accurate.

Effects of Proposed Activities

Timber Harvest and Meadow Restoration

Regal Fritillary

All three experts agreed that activities (such as timber harvest) that result in prairie and meadow enhancement could benefit the regal fritillary. Pine encroachment without treatment could be a problem (Backlund). Beauvais expressed that in a worst-case scenario, timber harvest could present a neutral effect. Beauvais continued that duration of effect could be long-term, if the scale of the project is large enough. He also stated that the overall effect of timber harvest activities would likely be minor, because only a small amount of fritillary habitat exists, and an even smaller amount would be treated. McDonald rated meadow restoration activities slightly different, by stating the direction of effect would be improvement, the duration would be medium-term, and the overall level would be widespread. McDonald added that scattering grasslands across the Black Hills might provide the best assurance for species occurrence on the Forest.

Tawny Crescent

Beauvais stated that timber effects would be neutral to the tawny crescent, particularly because there are several standards and guidelines that protect riparian areas. He thought the overall level of management activity would be minor. Backlund agreed that timber harvest would not have much impact on the tawny crescent.

Roads and Travel Management

Regal Fritillary and Tawny Crescent

Beauvais stated that road building could result in direct habitat loss for the butterflies, but other road management such as closures would likely mitigate the loss. Therefore, he believed that effects from roads and travel management would be neutral over the next five years, even though greater than 10 percent of the species habitat is open to vehicle traffic.

Livestock Grazing

Regal Fritillary

Backlund was not concerned about grazing unless extreme overgrazing or no grazing occurs. Decadent tall grass cover may inhibit growth of the violets that fritillaries are associated with. Conversion of rangeland to farmland presents the biggest threat to the regal fritillary, and this does not occur on the Forest.

Beauvais agreed that heavy grazing can reduce habitat quality, and could produce negative effects. He implied that in the absence of heavy grazing, effects could be neutral over an indefinite period of time. Negative effects from heavy grazing could be short-term or long-term, depending on how long this type of management occurs. Maintaining cover (stubble) height is important to the regal fritillary, and if grazing is negatively impacting cover, livestock management may need to be adjusted. Beauvais did not recommend an adequate cover height, but suggested research or monitoring be conducted to determine appropriate heights, site occupancy, and site fidelity. He also mentioned that egg masses are largely protected from grazing because they are present mostly when livestock are not on the Forest (September through April). In Beauvais' opinion, the overall level of grazing effects would be widespread, with more than 10 percent of the species habitat affected.

Tawny Crescent

The experts agreed that livestock grazing has the potential to impact the tawny crescent. McDonald expressed that the grazing standards and guidelines, when combined with those that would protect or maintain riparian areas in good condition, would benefit the tawny crescent. He assessed the direction of effect as an improvement (from historic management), duration as medium-term, and the overall level of management activity as widespread.

Beauvais stated that the direction of effect from grazing in riparian areas would be similar for the tawny crescent as he displayed for the regal fritillary (i.e., grazing could have negative or neutral effects, depending on intensity). Negative effects could be long-term and widespread.

In Backlund’s opinion, grazing management designed to benefit sensitive amphibians (i.e., northern leopard frog and tiger salamander) would probably also benefit the tawny crescent.

Noxious Weeds

Regal Fritillary

Beauvais stated negative effects from weed control could occur if herbicides were applied to violets, or if the overall loss of vegetation was great enough.

In the former case, he thought other plants that are not killed might serve as a secondary food source. In the latter case, the long-term result might be positive, as native species recolonized their niches. The overall level of weed control could be minor (less than 1 percent of the species range affected), due to the small number of acres expected to be treated. Beauvais also stated that the long-term effect of reducing weedy species would be minor.

Tawny Crescent

Beauvais stated that the noxious weed discussion for the regal fritillary is parallel to effects on the tawny crescent, except that implementation of riparian protection standards would lead to less negative effects to the crescent. There are possible negative short-term effects, and positive long-term effects, but because of the small amount of area treated for weeds, the overall level would be minor.

Insects and Disease

Regal Fritillary

According to Backlund, pesticide spraying could have a major affect on the regal fritillary. No further details were discussed, such as the likelihood that pesticides would be applied in meadows.

Prescribed Fire

Regal Fritillary

Beauvais stated that properly timed prescribed burns can be very helpful in enhancing long-term prairie conditions by increasing grass and forb cover. Short-term, negative effects could include burning of egg masses. Because of this potential, Beauvais felt that the change of Alternative 1 Guideline 3105 ("consider…regal fritillary butterflies prior to burning on prairies or meadows") to a standard under Alternative 2 would lead to neutral effects rather than negative effects. While Backlund asserted that 3105 was beneficial as a guideline in Alternative 1, McDonald disagreed that pre-fire surveys are necessary. In McDonald's opinion, surveying before every burn may be overkill for a species with limited habitat that is on the edge of its range. He thought it would be wiser to spend money and effort on either: (1) species that are more affected by management than by natural habitat limitations, or (2) examining natural population fluctuations of the two butterflies.

Tawny Crescent

Beauvais believed that because burning occurs so infrequently in riparian areas, there would be little if any effect from prescribed fire activities. Furthermore, because the amount of area is so small, the overall level of management activity would be minor.

Mining

Regal Fritillary

Beauvais felt that because little mining occurs in prairies and dry meadows, the direction of effect is neutral, the duration is not applicable, and the overall level of management activity is minor.

Tawny Crescent

Beauvais believed that because mining occurs so infrequently in riparian areas, there would be little if any effect from this activity. Furthermore, because the amount of area impacted is so small, the overall level of management activity would be minor.

Recreation

Regal Fritillary

Beauvais commented that because recreationists do not target butterflies, effects would be neutral.

Tawny Crescent

Beauvais thought that because riparian areas often draw recreationists, there could be neutral to negative effects to the tawny crescent. If use is chronic and heavy, effects could be long-term. He rated the overall level of management activity as moderate to widespread, because high recreational use occurs in riparian areas, which are not common to begin with.

Overall Effect on Capability to Support the Species

Regal Fritillary

Two of the experts independently expressed similar thoughts about the overall effect of Forest management on the regal fritillary. Backlund initially indicated some uncertainty in making a determination, due to the limited abundance of fritillaries and their preferred habitat in the Black Hills. McDonald indicated it is more difficult and less important to assess effects to the butterfly than to endemic species such as *Oreohelix* snails. However, they ultimately agreed that management would probably have little impact, mainly because the Black Hills are on the periphery of the fritillary's range. McDonald extended this statement by suggesting the fritillary might not lend itself well to intensive management or habitat improvement opportunities. Backlund added that populations in the Black Hills may be viable, but probably will not have long-term, continual persistence. Peripheral populations such as those in the Black Hills may appear and disappear, depending on such factors as weather (Backlund, McDonald). According to McDonald, the Forest probably cannot ensure local, regional, or global persistence of the regal fritillary. Regardless, he rated the overall effect of both alternatives as positive, due to the specific direction to provide and maintain open areas.

Beauvais stated that grazing would be the most widespread activity that could affect the regal fritillary. He expressed that effects from all other activities would not equal the effects of grazing, and they might even cancel each other out. The overall effect of the alternatives on the capability to support the species would then depend on how grazing is applied, and could be positive, neutral, or negative. Under both alternatives, Beauvais indicated the likely scenario would be either neutral or negative.

Beauvais identified knowledge gaps about the regal fritillary that could be answered through research. Included were site fidelity of fritillaries and relationship to vegetation height.

Tawny Crescent

Backlund felt the overall effect of the two alternatives was somewhere between neutral to positive. If effects were positive, they would be minor and/or short-term.

McDonald applied the same statement to both the tawny crescent and regal fritillary: butterflies often appear and disappear from areas, and the Forest probably cannot ensure local, regional, or global persistence of the species. However, over the next five years, he thought the overall effect on capability to support the species would be positive.

Beauvais believed that grazing has the highest potential to impact the tawny crescent, followed by recreation. He thought the only difference between alternatives 1 and 2 that would affect the crescent is the conversion of riparian guidelines to standards. Alternative 2 would benefit the butterfly.

INTERVIEW TEAM CONCLUSIONS

Regal Fritillary

Because the Black Hills area is at the edge of the species's range, habitat here is very limited. This, combined with the fact that the species is somewhat rare even in preferred habitat, suggests that there is little the Forest can do to assure the species occurs here consistently or abundantly. The most beneficial measure the Forest can take is to ensure responsible grazing practices, and continue meadow restoration activities. This will likely provide favorable conditions for the fritillary during times when it is close enough to find and use the habitat. There is no indication from the experts that the existing standards and guidelines in either alternative are insufficient for the regal fritillary. Instead, it appears more important that the Forest Plan be implemented and monitored closely in meadows where fritillaries or their habitat occur.

Tawny Crescent

There is no indication from the experts that the existing standards and guidelines in either alternative are insufficient for the tawny crescent. Instead, it is more important to implement and monitor the standards related to grazing and recreation,

particularly in riparian areas where tawny crescents or their habitat occur. Because the overall effect is expected to be neutral or positive for the tawny crescent, no additions are needed in the Phase I Amendment.

Phase I Recommendations

- Monitor implementation of standards and guidelines related to grazing and recreation in riparian areas.

Phase II Recommendations

- Beauvais suggested that the Forest identify and map suitable habitat for both butterfly species. This information could then be used during project planning.

- Beauvais and McDonald suggested that the Forest investigate patterns of site fidelity (including fluctuations in occupancy) for both butterfly species. However, McDonald also recommended that endemic species receive higher monitoring priority than the regal fritillary.

- Beauvais recommended the Forest conduct research on the relationships between vegetation height and regal fritillary habitat use.

SURVEY AND MONITORING METHODS

Backlund suggested that the best thing for monitoring butterflies would be to visit index sites during flight periods, and record presence/absence. This would be much cheaper than Pollard counts, and would document whether or not butterflies are still using an area. Index monitoring would allow several species to be monitored at once, given enough sites. He also specified that surveyors must have a trained eye to differentiate tawny crescents from other crescents. One way to accomplish this would be to contact Gary Marrone for access to mounted specimens.

SNAILS

SPECIES:

- Cooper's Rocky Mountain Snail (*Oreohelix strigosa cooperi*)
- Striate Disc (*Discus shemiki*)

EXPERTS:

- Doug Backlund, Biologist/Data Manager, Natural Heritage Program, South Dakota Department of Game, Fish and Parks, Pierre, South Dakota
- Gary Beauvais Ph.D., Wyoming Natural Diversity Database Director, Laramie, Wyoming
- Dave McDonald Ph.D., Associate Professor, University of Wyoming, Laramie, Wyoming

INTERVIEW RESULTS

Natural History Summary

These snails are found in mesic environments, next to riparian communities, on calcareous soils and north-facing slopes (Beauvais). They are associated with mesic forest floors because they cannot effectively regulate body fluids, and are susceptible to desiccation (Beauvais). According to Backlund, these snails often are hermaphroditic and bear live young. Theoretically, a single snail could emigrate and start a new colony.

Current Condition

There is a lot of uncertainty surrounding these land snails (Backlund). There is considerable habitat in the Northern Hills that appears to be suitable for *Discus shemiki*, but only a few colonies are currently known (Backlund). McDonald indicated that *D.shemiki* is fairly widely distributed in the western U.S., and the Black Hills populations are at the northeast edge of its range. He also noted that the Black Hills population is the only one to overlap with the fossil record, indicating a shift towards the West. McDonald felt that *O. s. cooperi* is endemic to the Black Hills and Forest management activities could have a more significant impact on this species than *D. shemiki*.

There is some discrepancy in the existing condition outcomes. McDonald thought that the current condition was similar to Outcome C for both species (suitable environments are frequently distributed as patches or they exist at low

abundance), possibly trending towards Outcome B (*D. shemiki*) or Outcome D (*O. s. cooperi*). Beauvais thought that suitable habitat for these snails is highly isolated and population abundance is low.

Effects of Proposed Activities

Timber Harvest

Beauvais did not elaborate on management effects, but did say that snails are very susceptible to timber harvest and soil compaction. He stated that the activities related to timber harvesting (i.e., reducing canopy closure, soil compaction and burning slash) present a worst-case scenario for these land snails. McDonald felt timber harvest, as described in the interview, would have a neutral influence on habitat conditions. He suggested studying snails at a variety of scales as a means to evaluate the impacts of timber harvest. There is probably less certainty about the effects to *D. shemiki*, because habitat relations are less obvious (McDonald). Backlund did not comment on effects of timber harvest activities.

Recreation

Impacts on snails from recreation activities are expected to be neutral (Beauvais) to positive (McDonald). Recreation activities were not considered a substantial impact to snails, though the level of recreational use is important (Beauvais).

Beauvais felt Alternative 1 would have a neutral to negative effect on snails. He felt Alternative 2 would be neutral, due to the increased strength of protection for known colonies. McDonald felt both alternatives would result in an improvement of habitat conditions. He felt Alternative 2 would have a stronger positive effect on habitat than Alternative 1. Backlund did not comment specifically on effects of recreational activities.

Livestock Grazing

There are examples in the West where livestock grazing was the principle cause of colony extirpation (Backlund). Beauvais did not elaborate on management effects, but did say that snails are very susceptible to grazing impacts, including soil compaction.

McDonald felt that the direction to “conserve” (Alternative 1) and “protect” (Alternative 2) would both result in improved habitat conditions, although Alternative 2 would be more beneficial to snails. The beneficial effects would be short-term and reversible (McDonald). Backlund felt that riparian area management direction in both alternatives would probably benefit *O. s. cooperi;* however little is known overall about these species (Backlund).

There is probably less certainty about the effects to *D. shemiki* because habitat relations are less obvious (McDonald).

Mining / Noxious Weeds / Prescribed Fire

McDonald thought the overall effects from mining would be minor, but could result in improved habitat conditions. There is a small chance that mining would occur on a snail colony, resulting in a small amount of habitat being affected (Beauvais). The effects would be mainly limited to unknown colonies (Beauvais). Beauvais felt mining would not likely significantly affect these land snails.

Beauvais indicated that weed control (spraying) could negatively affect snails and their habitat by removing vegetative cover. McDonald felt the overall effects from weed management would be minor, but could result in improved habitat conditions. The question is whether spraying for weeds or presence of weeds is worse for snails (Beauvais). There is no data that noxious weeds negatively affect snails (Beauvais). However, Beauvais recommended that site-specific evaluations be conducted prior to implementation of activities.

Beauvais felt that fire could cause degradation in habitat in general, but a cool fire might not have significant impacts. As long as burning does not occur at sites with known colonies, Beauvais expected effects would be minor. Prescribed fire would occur on a low percentage of the Forest and would likely affect less than 1 percent of the habitat, leading to minor overall level of effects (Beauvais). Beauvais noted there would be little difference between alternatives 1 and 2. McDonald indicated that prescribed fire activities would result in improved habitat conditions over the next five years.

Overall Effect on Capability to Support Snails

Beauvais indicated that both Alternative 1 and Alternative 2 would maintain snail colonies over the course of the next five years. Beauvais suggested developing a buffer around snail colonies to protect them from adjacent management activities. Beauvais pointed out that neither of the alternatives address currently unknown populations, and suggested it is important that the Forest start collecting data and modeling potential habitat as a means of estimating viability and population trends.

McDonald estimated that both alternatives would result in a positive capability to support the species, though Alternative 2 may be slightly stronger. McDonald suggested not applying a single management approach and allowing flexibility and variability to prevent drastic, widespread outcomes. The safest approach may be to apply protective measures to a subset of populations, and do nothing to the remainder, rather than apply protective measures to all known populations. McDonald felt that because *O. s. cooperi* is endemic to the Black Hills, Forest

management activities could have a more significant impact on this species than *D. shemiki*.

Backlund felt that over the next five years, effects of Forest activities would be negative, short-term, and not widespread. There could be some extirpation, but it would not affect the snails' entire populations across their ranges (Backlund). Backlund pointed out that there are three additional species of land snails (two *Vertigo* species and *Catinella gelida*) that also merit attention. Both the *Catinella* and *Vertigo* species are not addressed by the interim direction because they are not on the Region 2 sensitive species list. However, Backland recommended these species be protected in the same way as *O. s. cooperi* and *D. shemiki*.

Monitoring was mentioned in each interview as an important step towards better understanding these snail populations. Beauvais suggested that the Forest address the need for more extensive baseline information on colony locations, and a develop conservation/protection strategy for them. Information needs useful to management include developing models to describe potentially suitable habitat, and estimating viability and reproduction. Monitoring colony dynamics, longevity, etc., could be crucial to prevent listing under the Endangered Species Act (Backlund). McDonald emphasized that if a single snail management strategy was implemented across the entire Forest, there could be unexpected, negative consequences to the snail populations. Implicit in his recommendation is monitoring to determine the effectiveness of mitigation/protection.

INTERVIEW TEAM CONCLUSIONS

There is some discrepancy in the existing condition outcomes. McDonald considered the entire range of the species when making his determinations, and may not have understood that the Forest is mandated to manage for viable populations without regard to the species' distribution outside the Forest boundary. McDonald gave a more conservative outcome for *O. s. cooperi* based primarily on the fact that it is endemic to the Black Hills. As a generalization, the snails' habitats could be considered relatively patchy, low in abundance and at least somewhat isolated. Their ability to move among colonies or emigrate and establish a new colony is largely unknown.

According to the interview notes, effects from management activities vary from positive effects, to neutral effects, to slightly negative effects. As Backlund stated, even if known snail colonies are protected over the next five years, there still may be slightly negative impacts to unknown colonies. However, he indicated it would not likely affect the overall stability of the population. Based on the interview notes, both alternatives appear to adequately preserve options for *O. s. cooperi* and *D. shemiki* over the next five years.

One element lacking in both alternatives is protection for the additional snail species identified by Backlund and by Frest (1993). Both *Catinella* and *Vertigo* species are not addressed by the interim direction because they are not on the Region 2 sensitive species list. However, Backland indicated that protecting these species with the same measures developed for *O. s. cooperi* and *D. shemiki* would maintain options for them over the next five years. As a result, these species, along with two other species identified by Frest and Johannes (1993) as species of concern, were included in the recommendations below for the Phase I amendment.

Beauvais suggested developing a buffer around snail colonies to protect them from adjacent management activities. It is assumed that the Alternative 2 standard to "Protect known snail colonies" would include potential buffers if necessary to protect the colony.

Inventory and monitoring seem to be key consistent components of the scientists' responses. However, it is not clear that each of them were familiar with Frest's 1999 inventory and monitoring work. Protection (Alternative 2) was preferred over conservation (Alternative 1) under the assumption that it would be a more conservative approach to management, with a higher probability of colony survival. This conclusion was modified somewhat by McDonald because he was concerned that a single management strategy might yield unexpected results. He cautioned against a blanket policy in the absence of well-understood cause and effect information.

The interviews also identified the potential for studying snails at a variety of scales to evaluate impact from timber harvest. This opportunity is dependent on future funding and is not listed as a recommendation for Phase I or II.

Phase I Recommendations

- Ensure that all known colonies (as indicated in Frest [1993] and the subsequent Frest report [expected in year 2000]) are protected for the following seven snail species: *Vertigo arthuri*, *Vertigo paradoxa*, *Catinella gelida*, *Discus shimeki*, *Oreohelix strigosa cooperi*, *Oreohelix strigosa* n. subspp., *and Oreohelix strigosa berryi*.

- Develop and implement a strategy to monitor snail colonies during the Phase I Amendment process.

Phase II Recommendations

- Collect baseline information in preparation for the Phase II effort. Information collected should be useful in developing models to describe potentially suitable habitat as a means of estimating viability and population trends.

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APPENDIX A
PHASE I AMENDMENT EXPERT INTERVIEW PROCESS
BLACK HILLS NATIONAL FOREST

The following process was prepared prior to conducting the interviews in order to provide consistent structure throughout the interviews. The following interview process document was provided to those being interviewed, along with information about the Forest Plan and the interim direction (October 12, 1999), to give those being interviewed the opportunity to familiarize themselves with the process and information prior to the interview. The reader should remember that this appendix was prepared prior to the interviews, and therefore, may have a slightly different style than the interview summaries.

PHASE I AMENDMENT EXPERT INTERVIEW PROCESS
BLACK HILLS NATIONAL FOREST

INTRODUCTION

The Phase I Expert Interviews will result in a description of the outcome and effects to species (with associated rationale from scientific experts) of implementation of the Revised Forest Plan (Alt. 1), and implementation of the Revised Forest Plan with incorporation of additional protective measures (Alt. 2), over the next 5 years.

Expert interviews will take place over one to two days each, depending on the number of species to be addressed. Scientific experts will be interviewed individually. Attendees will include an interviewer, the scientific expert(s), a recorder to capture pertinent discussion, and a local resource specialist to answer species and habitat specific questions. The interviews will focus primarily on those species specifically addressed in the Interim Direction.

SELECTION OF EXPERT INTERVIEW TOPICS

Species included in the Phase I analysis, and included in the Phase I Expert Interview process, will be Region 2 sensitive species that occur or are likely to occur on the Black Hills National Forest. The October 12, 1999 appeal decision and the Interim Direction contained therein, focused on sensitive species. Also, sensitive species are those species with the most concern for viability. The purpose of the Phase I process is to incorporate additional protective measures into the Forest Plan through an amendment. Therefore, it is logical to include sensitive species in the Phase I Expert Interview review process.

We then grouped similar species together to form interview topics. This was partly an effort to reduce the number of scientific experts needed for fiscal reasons, and partly to facilitate discussions for similar species. Goshawk and marten were not grouped with other species because they are individual issues to Forest management, they have the potential to over-shadow other species if included in a larger group, and they are addressed specifically with Interim Direction in the appeal decision (October 12, 1999). Cavity dependant species formed another group because they were also specifically addressed as a group in the snag portion of the Interim Direction.

SELECTION AND DUTIES OF SCIENTIFIC EXPERTS

Scientific experts will be drawn from various Federal agencies, state government agencies, and other private organizations. Individuals should all have recognized expertise in the area to be evaluated, including technical knowledge of the species/group, and an ecological understanding of general habitat requirements. Efforts will be made to select individuals who could set aside values of interested groups and focus on the scientific aspect of the task.

The overall makeup of the group of experts to evaluate each species/group should contain a range of expertise for both the species and its geographic range, a mixture of research and management backgrounds, and perspectives from habitat and population viewpoints.

Pre-work packages will be sent to individuals approximately two weeks prior to the interview meeting, and will include the following materials:

- Description of the interview process.
- Brief description of each alternative, including standards and guidelines that pertain to each species/group (positively or negatively affecting that species/group).
- *A Century of Change in Black Hills Forest and Riparian Ecosystems*.
- Excerpts from Forest Plan for background on unique ponderosa pine ecosystem and fire history.
- List of data and information that will be available during the interview session.

Individuals will be asked to familiarize themselves with this material prior to the interview date, and encouraged to gather appropriate materials to bring with them to the meeting.

SELECTION AND DUTIES OF INTERVIEWER

The interviewer will be a Federal government employee with intimate knowledge of the purpose, process, and expected results of the interview process. The interviewer will lead an initial discussion focusing on the alternatives to be evaluated, activities anticipated to occur as a result of the Phase I Amendment, and data/conditions specific to the Black Hills. The interviewer will then lead discussions regarding the current condition of the species/group, its habitats, and populations, effects of proposed activities, and overall effect on capability to support species. Finally, the interviewer will lead a discussion to identify survey and monitoring protocols, and potential mitigation measures that could be applied.

SELECTION AND DUTIES OF RECORDERS

Recorders will be Federal government employees who have the word processing skills and experience to be able to capture any pertinent discussion between the scientific expert and the interviewer. A Local Resource Specialist will be available to assist the recorder with scientific terminology and concepts with which the recorder may be unfamiliar. They will document the discourse on a computer that may be attached to an overhead projector during the meeting. This will allow continuous feedback to ensure correct interpretation and documentation of the discussion. The notes will be sent to scientific experts for review to ensure accuracy. This documentation will be used to clarify and track points cited by the scientific experts and to support later interpretations.

SELECTION AND DUTIES OF LOCAL RESOURCE SPECIALISTS

Resource specialists will be Federal employees with sufficient expertise to provide local knowledge on the interview subject matter. They will be available to answer questions about local conditions and to obtain additional GIS maps or information. The resource specialists may also present species specific information at the beginning of the interview.

INTERVIEW PROCESS

Purpose of Phase I Interview Process

The purpose of the Phase I Amendment Expert Interviews is to assess the short-term effects (until the Phase II Amendment is completed) on selected species of implementing the Phase I Amendment alternatives. Long-term implications of the short-term effects will also be considered. Scientific experts will review and estimate the effectiveness of the measures proposed for adoption as the Phase I Forest Plan amendment. The focus will be the subject matter of the Phase I Amendment, including monitoring, changing all guidelines to standards, and specific needs for goshawk, marten, snails, and cavity-dependent species.

Objectives for the Phase I Expert Interview process are:

- To assess the current conditions for species
- To assess the effects of the Revised Forest Plan, including the additional protective measures, on species. Assessment will be based on immediate effects (5 years) and longer-term implications of those effects.
- If the additional measures have limited effectiveness in providing capability to support species, obtain information on factors causing such inadequacies and other measures that would be more effective.

Orientation Discussion

The interviews will begin with a discussion that will provide essential, well-synthesized, and distilled information to the scientific experts to help them understand the context of the advice they are providing. This discussion will include the following:

- Introduction
- Purpose and Need
- Background of the issues at hand
- Data/conditions specific to the Black Hills
- Current habitat conditions on the Black Hills National Forest and surrounding ownerships
- Discussion of Interim Direction
- Protective measures included in the Phase I Amendment alternatives (standards and guidelines)
- Projection of activities that will occur as a result of the Phase I Amendment
- Five-year action plan.
- The interview process itself
- Expectations for products

The session will begin with an introductory discussion regarding the environmental setting of the Black Hills; the Forest Planning process; and an overview of recent events affecting forest management (e.g. Forest Plan revision, Interim Direction); and the alternative development process used in this planning effort. Habitat issues specific to the Black Hills will be highlighted (island in the plains, land ownership patterns, past timber harvesting practices, historical distribution of species, uniqueness of the Black Hills ponderosa pine ecosystem, etc). The alternatives that are to be assessed will be described in detail. Specific questions relative to the alternatives may be addressed to the local resource specialist and answered.

Following this overview, a detailed description of the assessment procedures will be discussed with examples. This will include a statement on the purpose of conducting the interviews and an explanation of how the planning team will use the information. This session will include a focused introduction on the role of scientific experts, local resource specialists, and recorders. It will also be made clear that we know very little about some species on the Black Hills. It will also be emphasized that factors exogenous to the alternatives, including natural disturbances, should be treated as risk factors and as such fully considered. Finally, it will be stressed that the Forest is not asking for a decision, but for advice and information. The Forest will use that advice and information in the documentation for the Phase I Environmental Analysis and in the design of alternatives and appropriate mitigation measures for the Phase II Amendment. A question and answer process will follow.

INTERVIEW SESSION

At the beginning of each interview, the local resource specialist or interviewer will lead a Black Hills-oriented discussion on the species/group and the current status of habitat and population (if known) for that species/group. This discussion will likely include the biology of the species/group and its habitat requirements. Following this initial discussion of each species/group, the evaluation process will proceed in 3 distinct steps.

Step 1 – Current Condition

Scientific experts will provide an estimate of the current condition for each species/group as described by the following outcome statements.

- **Outcome A**. Suitable environments are broadly distributed and of high abundance across the range of the species. The combination of distribution and abundance of environmental conditions provides opportunity for continuous or nearly continuous intraspecific interactions for the species.

- **Outcome B**. Suitable environments are either broadly distributed or of high abundance across the range of the species, but there are temporary gaps where suitable environments are absent or only present in low abundance. However, the disjunct areas of suitable environments are typically large enough and close enough to permit dispersal and interaction among subpopulations across the species' range.

- **Outcome C**. Suitable environments are frequently distributed as patches or they exist at low abundance, or both. Gaps, where suitable environments are either absent or present in low abundance, are large enough that some subpopulations are isolated, limiting opportunity for species interactions. There is opportunity for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are so disjunct or of such low density that they are essentially isolated from other populations. For species for which this is not the historical condition, reduction in overall species range from historical conditions may have resulted from this isolation.

- **Outcome D**. Suitable environments are highly isolated or they exist at very low abundance, or both. While some subpopulations associated with these environments may be self-sustaining, there is limited or no opportunity for population interaction. There has likely been a reduction in overall species range from historical conditions, except for some rare, local endemics that may have persisted in this condition since the historical period. For species for which this is not the historical condition, reduction in overall species range from historical conditions may have resulted from this isolation.

- **Outcome E**. Suitable environments are highly isolated and exist at very low abundance, with little or no possibility of population interactions, resulting in strong potential for local or regional extirpation, and little likelihood of recolonization.

Following discussion on species biology and habitat conditions, each scientific expert will select an outcome that best describes the current condition for each species, and verbally express their rationale for their outcome selection to clarify their interpretation of available knowledge, identify knowledge gaps, and clarify how this lack of information was handled.

Step 2 – Effects Of Proposed Activities

Following the estimation of current condition for each species, the interviewer and scientific expert will discuss the effects of the types of management proposed for the habitats occupied by the species. For species/groups affected by more than one type of activity, this process may be iterative. In this step, the scientific expert will identify the likely direction of effect of each type of management activity proposed, the

duration of that effect, and the overall magnitude of effect on species habitat. Effects of management activities will be estimated for both alternatives, and experts will be encouraged to discuss their rationale. The following set of definitions will be used for this discussion.

I. Effects of individual management actions, with proposed standards and guidelines in place, on species habitat conditions**. This is the estimated effect of the management action on the site where the management activity takes place. It does not consider the Forest-wide level of management activity.**

A. Direction of effect:

1. **Management activities result in an improvement of habitat conditions from the condition existing just prior to the application of the activity, potentially resulting in a change from unsuitable to suitable conditions for the species, or from low to high habitat quality.**
2. **Management activities result in a neutral effect on habitat conditions.**
3. **Management activities result in a degradation of habitat conditions from the condition existing just prior to the application of the activity, potentially resulting in a change from suitable to unsuitable conditions for the species, or from high to low habitat quality.**

B. Duration of effect:

1. **Short term: the area affected by the management action is likely to revert to pre-activity condition within five years.**
2. **Medium term: the effect of the management action is likely to persist for five to twenty years.**
3. **Long term: the effect of the management action is likely to persist for more than two decades, and may be permanent.**

II. Overall level of management activity**. This is an estimate of the portion of the species' habitat that would be affected by management activity during the assessment period (i.e., 5 years).**

A. Minor: less than 1% of the species' habitat would be affected.
B. Moderate: 1 – 10 of the species' habitat would be affected.
C. Widespread: greater than 10% of the species' habitat would be affected.

Step 3 – Overall Effect On Capability To Support Species

The final step will be to estimate the overall effect of alternatives on capability to support species. This estimate will focus on 5 years of activities, but will consider long-term implications of the activity conducted during that 5-year period. Experts will be asked to select one of four outcomes (shown below), or descried an outcome in their own words, that best describes the overall effect of each alternative on capability to support species. The four outcomes are defined as follows:

A. Positive: effects on capability to support species are positive.
B. Neutral: effects, positive or negative, are minor and/or short term.

C. Negative: Effects on capability to support species will be negative, but are short term, and/or not widespread, and/or do not result in reduced management options and increased risk of extirpation.

D. Strongly negative: Negative effects of management on species habitat conditions over the next 5 years will be widespread, and medium or long term. As a result, management options will be foreclosed, with increased risk that local or broader extirpations will occur over the long term.

The interviewer will then begin a final discussion to identify which elements or factors played an important role in their selection of outcomes for each species or group of species. This discussion may also provide insight into potential species conservation strategies or thresholds for particular species specific risk factors. Experts will also be asked to identify specific alternative components that could be modified to improve the outcomes, as well as components that could be added to improve the outcomes. This final discussion will include a request for recommendations from the expert regarding monitoring and survey protocols, and project level mitigation measures that could be applied.

Appendix B
Authors, Experts, Interviewers, and Recorders

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