Wildlife Analysis

Changes Between Draft and Final

- Comparison between alternatives for those analyses requiring road and trail density by Alternative were computed for the DEIS since there was an associated Travel Management Plan but were not computed for the FEIS since there was not an associated Travel Management Plan.
- Management Indicator Species selection process was revised from the draft to the final. The process used in the draft is presented in this section. The process used in the final based on new direction is presented later in this Appendix.
- Other changes are noted in specific areas of this section.

The wildlife analysis for the EIS consisted primarily of:

- Selection of management indicator species (for the DEIS only),
- Interior habitat evaluation,
- Habitat connectivity evaluation,
- Road and trail density determinations (for DEIS only),
- Elk habitat effectiveness evaluation, and
- Lynx viability assessment (DEIS only; not used for FEIS since 2002 Forest Plan direction incorporated the direction the Lynx Conservation and Assessment Strategy, and the Forest conducted a Forest-wide viability process to identify Species of Viability Concern).

Note: *This was the process for identifying MIS for the DEIS. Forest Service direction for identifying MIS was revised since the release of the DEIS. The process used for identifying MIS in the FEIS is presented later in this Appendix.*

Management indicator species (MIS) have been used in one form or another over the last 30 years as a biological monitoring tool to suggest whether or not changes in wildlife populations have been occurring in response to anthropogenic influences on landscapes (McLaren et al. 1998). During the 1980s, the Forest Service promoted MIS analysis as a technique for evaluating effects of management proposals. The basic idea of MIS analysis is to limit the scope of analysis to an individual species that represents a suite or guild of species that have similar habitat requirements. By providing sufficient habitat for an indicator species, habitat for the suite would also be provided, thereby providing greater protection for more than just one species.

The goal of MIS analysis is to identify vegetation conditions on the landscape that might not provide for viable wildlife populations. Such analysis would highlight management prescriptions or land allocations that might be in conflict with conservation responsibilities. In addition, Noss and Cooperrider (1990) described management indicator species analysis as the most important process component for establishing a monitoring program, and that management indicator species analysis has utility in adaptive management programs for forest management.

Noss (1990) and Hunter (in McLaren et al. 1998) have suggested using a *coarse filter/fine filter* approach to address biological diversity. The coarse filter concept uses certain large-bodied wildlife and broad ecosystems, while the fine filter approach uses certain plants, small-bodied animals, and forest structural components. Management indicator species analysis is a fine filter approach.

Simberloff's paper on single species management (1998) points out some pitfalls that occur when allowing a single species to act as a surrogate for other similar species. First, there is little consensus on what an indicator is supposed to indicate, and even when agreement is reached, there is little consensus on which species would be the most appropriate. He has suggested that *keystone* species might be a better approach to addressing biological diversity, an approach which melds single species and ecosystem management into one concept (Simberloff 1998).

The National Forest Management Act of 1976, the National Environmental Policy Act of 1970, and Forest Service Manual 36 CFR 219.19 direct agencies to consider fish and wildlife resources when preparing or revising land management plans. These and other statutes and regulations require the agency to maintain habitats for viable populations of existing native and desired nonnative vertebrate species in sufficient numbers and distribution of reproductive individuals to ensure their continued existence in the planning area (in this case, White River National Forest). The manual also requires the agency to select management indicator species to estimate the effect each alternative has on fish and wildlife habitats, and its subsequent effect on wildlife populations, vegetation communities, and other ecological components.

Management indicator species were selected based on a model developed by McLaren et al. (1998) used in a province of Ontario, Canada. McLaren evaluated species as to their suitability for use as an indicator species by looking at the biology of the animal, methods available for monitoring, and regulatory status of the species. These criteria were viewed as hierarchical, with biological being the most important and status the least. The biological criteria were largely based on how responsive a species is to forest management, but consists of several factors, in combination:

- *Species plasticity* – For a species to qualify within the biological criteria, it must be dependant on a specific habitat and be sensitive to changes in that habitat. Most species have specific habitat requirements. However, some species are generalized in their habitat requirements and can mold to a variety of conditions. These species are considered "plastic" and are not suitable for use as indicators, e.g. the coyote (*Canis latrans*).
- *Typical causes of population change* – It is important to avoid using species where changes in populations are often not directly related to forest management, but rather other causes.
- *Size of home range* – Noss (1990) noted that the selection of management indicator species must account for scale, since forest management can affect specific sites as well as entire landscapes. In addition, the hierarchy theory suggests that to observe an effect on one species at one scale requires assessing change at the next larger scale (McLaren et al. 1998). Therefore, species should be selected that reflect a range of home range sizes, so that responses to forest management at all scales can be evaluated. Several authors (Harestad and Brunnel 1979) suggest that body size is correlated to home range size. To this end, species were pooled by body size as they relate to three different spatial scales: stand, forest, and landscape.
- *Life history requirements* – Use of resident species over migratory ones can help focus managers attention to species that are truly affected by local forest management actions and not the result of effects at a distant breeding ground. This is not to

discount the importance of maintaining breeding habitat for migratory species or that population trends can differ between short-distance or long-distance migrants.

- *Trophic level* – There should be indicator species which are representative of each of the trophic levels, carnivores, omnivores, and herbivores, with some consideration to the degree of specialization within a feeding strategy (for example, insectivore or vertebrate predator within the broad carnivore grouping).
- *Degree of specialization a species has to a particular habitat* – Monkkonen and Welsh (1994) suggest that species requiring large expanses of coniferous or deciduous forests without specializing within those forests are highly susceptible to changes at the broad scale. Other species may be more keyed to certain components of the forest stand, such as those that require large dead trees or where feeding behaviors are a result of some vertical stratum. Highly specialized species may or may not be appropriate for use as a management indicator species.

The methods criteria ensured that survey and monitoring techniques are available and implementable to address questions related to specific forest management practices. McLaren et al. (1998) used the methods criteria for designing a monitoring program and for evaluating the availability of tools to provide reasonable estimates of changes in population sizes. Since most forest species are hard to observe, sampling methods must lead to a reasonable degree of success of finding the species, since samples with a large number of zeros can lead to wide confidence intervals (McLaren et al. 1998). Cochran (in McLaren et al. 1998) suggested that the problem of unequal distribution might be overcome by a stratification of the sampling effort. He cautions that before one launches into a long term monitoring effort, that strict attention to the details of sampling is considered thoroughly.

Some authors (Walters and Holling 1992, Noss and Cooperrider 1994) report that a monitoring program should have adequate controls to ensure that changes in species abundance can be attributed to the effects of the management action, and are not the result of some other factor, such as climate change. It is important to note that although controls may be available for small-bodied animals at the stand and forest scale, such controls may not be possible at the landscape scale. Forest or other representative landscape vegetation types should be available in some type of reserve system so that they may serve as a benchmark to compare the effects of the forest activity (Rowe 1972).

Cost-effectiveness is an important consideration of any long-term monitoring program. Selecting a sampling protocol that yield valid results that are cost-effective are important considerations when designing the overall monitoring program.

The status criteria was a mix of legally mandated requirement and guidelines emphasizing the importance or value placed on certain species by the public. Threatened, endangered, proposed, sensitive, or public-featured species must be considered as indicator species. In addition, using species held in high esteem by certain segments of the public, such as the game species, to discuss the effect of changes in the landscape is often more effective than using less known species.

Table B-37 displays the species selected as management indicator species. **Table B-38** displays species that were considered but not selected.

Table B-37
Management indicator species

Community	Trophic Level	Species	Scale*
Foothills (shrub/grass)	Herbivore (foliage)	Elk	Stand, Forest
Late-successional conifer	Carnivore	Pine Marten	Stand, Forest
	Insectivore	Three-toed Woodpecker	Stand
Interior forest	Insectivore	Brown Creeper	Stand
Younger seral forest	Herbivore (foliage)	Snowshoe Hare	Stand
Alpine riparian (willow)	Omnivore	White-tailed ptarmigan	Stand
Aspen	Insectivore	Red-naped Sapsucker	Stand
	Insectivore	Purple Martin	Stand
Sagebrush	Insectivore	Brewers Sparrow	Stand
Deciduous riparian	Insectivore	Yellow warbler	Stand
Piñon-juniper	Herbivore (foliage)	Elk	Stand, Forest
	Insectivore	Plumbeus Vireo	Stand
Mixed shrub	Herbivore (foliage)	Elk	Stand, Forest
	Insectivore	MacGillivary's Warbler	Stand
Grasslands	Insectivore, Herbivore (foliage)	Horned Lark	Stand
	Insectivore	American Pipit	Stand
Rock and water	Insectivore	Black Swift	Micro-scale
Caves	Insectivore	Townsend's Big-eared Bat	Micro-scale
Cliffs	Carnivore	Peregrine Falcon	Micro-scale

Note: * Stand = 25-2,500 acres; Forest = 2,500-25,000 acres; Landscape > 25,000 acres.

Table B-38
Species considered but not selected as management indicators

Species	Rationale for dropping from consideration
Green-tailed Towhee	Other species selected to cover similar community characteristics
Virginia Warbler	Other species selected to cover similar community characteristics
Southern Red-backed Vole	Other species selected to cover similar community characteristics
Pygmy Shrew	Habitat generalist
Dwarf Shrew	Habitat generalist
Whooping Crane	Pass-over migrant, uncommon on forest
Boreal Owl	Other species selected to cover similar community characteristics
Common Loon	Pass-over migrant, uncommon on forest
Merlin	Effects of management practices difficult to assess
Sandhill Crane	Other species selected to cover similar community characteristics
Pygmy Nuthatch	Not selected, very few acres on forest in this conifer type
Hairy Woodpecker	Other species selected to cover similar community characteristics
Mule Deer	Other species selected to cover similar community characteristics
White-faced Ibis	Pass-over migrant, uncommon on forest
Ferruginous Hawk	Typically lower elevation, uncommon on forest
Wilson Warbler	Other species selected to cover similar community characteristics
Golden-crowned Kinglet	Other species selected to cover similar community characteristics
Dusky Flycatcher	Habitat generalist

Interior habitat

Interior habitat conditions on the Forest were analyzed by delineating distinct habitat patch groupings, using the common vegetation database (CVU), and then doing fragmentation analysis with the FRAGSTAT model. **Table B-39** identifies the breakdown of CVU data into the categories needed for FRAGSTAT input. Structure Code 5 (Frag Code 5) areas were used to build a core habitat map. Frag Code 5 represents

Structural Stages 4b, 4c, and 5. Normally, only 4c and 5 would be used in the core habitat analysis, however, since 4b is a component of the Frag Code 5 mapping, it is also be displayed in the analysis. A value of 65 meters was used to identify and model interior forest habitat. In the central-southern Rocky Mountains, this distance is roughly one and half to two tree heights for most coniferous species. Only Frag Code 5 polygons (deciduous and conifer core habitat) need to be buffered 65 meters inward to depict the area shown as core habitat. The other patch codes were disregarded for this analysis.

Fourth code watersheds on the forest were used as the basic analysis unit to run the FRAGSTAT modeling against the vegetation classification. Two different vegetation data sets were used to run the FRAGSTATS model against the 4th Code watersheds. The first data set excluded the use of patch code 27, and the second data set included patch code 27. By using the two data sets in combination, a comparison of the effects on patch size can be made, with and without considering roads, railroads, utility corridors. The data output stream from FRAGSTATS, along with the development of an interior habitat map, provide the basis for discussion related to the effect the various alternatives have on patches, and hence interior forest habitats.

Habitat connectivity

The same distinct habitat patch groupings used for the interior habitat analysis were used as a starting point for habitat connectivity analysis. The patch codes were then grouped into four distinct classes:

- Class one displays all conifer forest types (Douglas-fir, spruce-fir, and lodgepole pine) in structural stages 3a, 3b, 3c, 4a, 4b, 4c and 5.
- Class two covers all deciduous forest types (aspen and cottonwood) in structural stages 3a, 3b, 3c, 4a, 4b, 4c and 5.
- Class three outlines all the shrub cover types (piñon/juniper, grass, sagebrush, rabbitbrush, and other shrubs) and the seedling-sapling component from the deciduous and conifer components (structural stage 2).
- Class four is the open components that either lack vegetation or rarely have it. This class is barren areas and the open corridors created from road, utility, and railroad corridors.

Table B-39
Habitat patch groupings using the CVU database

Patch code	Species group	Species	Structure code	Structure stage
1	Df	Douglas-fir	1 – Seed/sapling	2
2	Df	Douglas-fir	2 – Sapling/Pole	3a
3	Df	Douglas-fir	3 – Sapling/Pole	3b, 3c
4	Df	Douglas-fir	4 – Mature	4a
5	Df	Douglas-fir	5 – Mature/Old Growth	4b, 4c, 5
6	Sf	Spruce fir	1 – Seed/sapling	2
7	Sf	Spruce fir	2 – Sapling/pole	3a
8	Sf	Spruce fir	3 – Sapling/pole	3b, 3c
9	Sf	Spruce fir	4 – Mature	4a
10	Sf	Spruce fir	5 – Mature/old growth	4b, 4c, 5
11	As	Aspen	1 – Seed/sapling	2
12	As	Aspen	2 – Sapling/pole	3a
13	As	Aspen	3 – Sapling/pole	3b, 3c
14	As	Aspen	4 – Mature	4a
15	As	Aspen	5 – Mature/old growth	4b, 4c, 5

Patch code	Species group	Species	Structure code	Structure stage
16	Lp	Lodgepole pine	1 – seed/sapling	2
17	Lp	Lodgepole pine	2 – Sapling/pole	3a
18	Lp	Lodgepole pine	3 – Sapling/pole	3b, 3c
19	Lp	Lodgepole pine	4 – Mature	4a
20	Lp	Lodgepole pine	5 – Mature/old growth	4b, 4c, 5
21	Cw	Cottonwood	All structural classes	All
22	Pj	Piñon-juniper	All structural classes	All
23	Ba	Barren	Not applicable	
24	Gr	Grass	Not applicable	
25	Sr	Sagebrush/rabbitbrush	Not applicable	
26	Sh	Shrubs	All	
27	n/a	Road/utility/etc	From timber suitability	

Note: *Lumping of Structural Stage 4b into the Patch Code 5 (mature/old growth) designation may skew the results slightly, since most interior habitat analyses typically use 4c and 5 classifications.

A forest-wide map of these four classes was the basis for analyzing potential landscape connectivity. Other elements were then factored into the analysis, including:

- A recreation impact map for the forest was constructed using the land allocation status for Management Areas 8.21 (developed recreation complexes), 8.25 (ski-based resorts) and 8.31 (aerial transportation corridors).
- Lands allocated to utility corridors (Management Area 8.32) were incorporated into the overall connectivity map analysis.
- Major road systems occurring on the forest were incorporated into the overall connectivity map analysis.
- Areas where forest roads or trails may impact or impede animal movement across landscape where identified using a *moving windows* procedure (discussed briefly below).

This analysis resulted in identification of areas that are allocated to Management Areas 1.41 (core areas) and 3.55 (corridors connecting core areas). These management areas allocate lands to maintain connected habitats across the forest for protecting migration and dispersal areas.

Road and trail density

NOTE*: Road density was computed for each alternative in the DEIS since there was an associated Travel Management Plan. Road density was not computed for each alternative in the FEIS since there was not associated Travel Management Plan.*

Road density is calculated by dividing the total miles of open road by the total square miles in an analysis area, resulting in an average road density. While average road density provides meaningful information on the effectiveness of habitat for some species, such as big game, it is completely meaningless for other species such as amphibians. Even when used for evaluating the habitat effectiveness for big game species, the utility of average road density is limited because large unroaded areas within the analysis areas skew the calculation and dilute the potential effects of the roads. Generally, trail density as an index is rarely used, but rather, other measures are used such as length, use level, human use difficulty level, and user type (motor bike, motorized, cross country skiing, hiking, pack and saddle trail). These more typically used measures do little to enhance our knowledge about effects to wildlife resources, such as direct habitat loss and fragmentation, or indirect factors related to disturbance and displacement.

The Interagency Grizzly Bear Committee (IGBC) taskforce, the Pacific Northwest Region (Region 6 - Draft Road Analysis Protocol), and Rio Grande National Forest (Region 2) have developed some protocols for assessing motorized access and travel management issues on National Forest System lands. These protocols have been compiled and modified to address road- and trail-related issues on the forest. The process can be adapted to fit the needs of any resource specialist trying to assess the effects of road density. Using this methodology has the following benefits:

- The system provides a spatial overview of road density using increment classes of one mile. The user can see where road and trail density is highest within an analysis area, and where the high density occurs in relationship to fish and wildlife habitats, and other sensitive areas (such as highly erodible soils).
- Scale can be easily varied in the system to provide road and trail density data for a variety of resource management needs. For example, in a given analysis area, multiple data queries can display the percentage of key elk calving areas with greater than 2.0 miles/square mile of road or motorized trail; the percentage of amphibian habitat with zero miles/square mile of road; and the percentage of wolverine or lynx habitats with greater than 1.0 miles/square mile of roads or trails.

The following definitions and procedures used to calculate road and trail densities are applicable generally forest-wide, but may be modified when used during site-specific analysis. Site-specific decisions for meeting revised forest plan management area allocations and ROS classes are being prepared by a separate Road and Travel Management Interdisciplinary Team. For wildlife analysis, road and trail terminology is used as follows:

- Road – All created or evolved routes that are greater than 500 feet long that are reasonably and prudently drivable in a motorized vehicle licensed for use on public highways.
- Open road – A road without restrictions on motorized vehicle use (Classified in the Travel Management System (TMS) as road maintenance levels 2-5.)
- Motorized trail – all created or evolved access routes that do not qualify as a road that are used by motorized vehicles.
- Open motorized trail – A trail open to motorized use without any restrictions.
- Restricted motorized trail – A trail where motorized use is restricted seasonally or yearlong. Motorized vehicle use may be legally restricted. Other uses such as hiking, mountain biking (mechanized), or pack and saddle are generally the dominant uses, collectively, in some combination, or as a single use.

(NOTE: *If road and trail density are to be determined where the issue is motorized use only, then those roads and trails having such use would be used in the calculation. If the concern were strictly hydrological, then all roads and trails (except obliterated) would be included in the density calculation. Roads that meet the combined definitions for "obliterated and decommissioned" are not to be considered in determining road density for other applications.)*

The central element of road and trail density calculation procedure was a *moving window* GIS procedure. In a *moving windows* analysis, each pixel (square unit of land) is assigned an access route density value based upon the roads and trails within the surrounding one square mile. The square mile is the *window* surrounding a pixel. Starting in the upper left corner, the first pixel is assigned an access route density value based upon its surrounding 1 square mile window; the program moves over 1 pixel and assigns this next pixel a density value based upon its surrounding 1 square mile window; move over 1 pixel and that pixel is assigned a density value; and so forth until the entire file has been analyzed pixel by pixel. This is then be summarized as the proportion of a given analysis area in various road density classes. For moving windows analysis the same GIS software was used for all comparative analysis of outputs, to ensure consistent evaluation. The forest used ARC/Info Grid (615) and the road density AML obtained from Host=R06B, Staff=IR, Drawer=ARC, Folder=LIBRARY, Object=ROADDENSITY.TAR.

Particulars of the road and trail density evaluation conducted for this analysis include:

- The scale of analysis areas delineated varied based on the species being evaluated. An area that encompasses several thousand acres and spans multiple sub-watersheds may be appropriate for road density analysis for wolverine. In contrast, a 200-acre plot within a unique drainage may be an appropriate scale for effects analysis on a rare amphibian species.
- The window shape was a CIRCLE with an area of one square mile.
- The size of the pixels was one acre. With a decrease in pixel size, processing time increased exponentially and accuracy was not greatly improved.
- Density was calculated by 1) summing the lengths of the roads and trails within each pixel within the window and then dividing by the size of the window, or 2) using the GRID LINEDENSITY function (in ARC/Info version 7.1+).
- For accurate calculation of densities, it was necessary to include all the roads and trails within at least 0.6 miles of the outer boundary of the analysis area.
- Access route maps were developed by identifying and categorizing all roads and trails in the analysis area(s) as 1-open road, 2-open motorized trail, 3-open mechanized trail, and 4-open to any use.

Access categories used for this analysis were (defined via a remap table):

< 0.1 miles per square mile

0.1 to 0.5 miles per square mile

0.5 to 1.0 miles per square mile (Management area 5.43)

1.1 to 2.0 miles per square mile (Management areas 3.21 and 5.45)

1.2 > 2.0 miles per square mile (Management area 5.4)

Elk habitat effectiveness (Habitat effectiveness index)

NOTE: *Habitat effectiveness index was computed for each alternative for the DEIS, incorporating the draft Travel Management Plan. It was not computed for each alternative in the FEIS since there was no associated Travel Management Plan.*

Vegetation communities of certain character are habitat for elk. The effectiveness of these elk habitats in supporting elk populations was evaluated using the Habitat Capability Model (HABCAP) originally developed by Richard Holthausen for the Rocky Mountain Region of the Forest Service. The HABCAP model provides estimates of the capability of habitats to support wildlife based on the mix vegetation cover types and structure present in an area. Hoover and Willis's (1984) *Managing Forested Lands for Wildlife* (Chapters 3, 7, and 8) documents the basis for the different elements in the HABCAP model (see also the HABCAP Documentation and Users Guide No. 011090 (not dated). The program is menu driven for vegetation cover type and wildlife indicator species. The HABCAP model was used to compute the Habitat Effectiveness Index for elk. Primary assumptions of the HABCAP model include:

- Carrying capacity is based on forage,
- The ability of animal to utilize forage is modified by cover and roads (elk only),
- Acres providing forage and cover are not necessarily mutually exclusive, and
- Animals have a limited ability to compensate for differing quality and quantity of cover and forage.

The HABCAP model utilizes 14 cover types and 45 indicator species. A specific depiction of the cover types and structural stages are described on page III-5, and indicator species on page III-3 of the draft HABCAP Documentation and Users Guide.

In the HABCAP model, the geometric mean is used to combine feeding and cover indices into an overall habitat capability index, as a way of displaying the ability of animals to compensate for less than optimum cover, provided the value of the area for forage is sufficiently high. Since the geometric mean produces smaller values than the arithmetic, it is considered a more conservation and incomplete approach for reflecting compensation (Suring 1985). Biologically, there appears to be a threshold at which the animal can no longer compensate, no matter what the value of forage, however, that threshold has not been established (USDA 1981).

Areas used for analysis should be large enough to contain seasonal home ranges of the most mobile indicator species. Using a large enough area allows the model to analyze and portray cumulative effects of all management actions and natural process that would affect a species seasonal home range (USDA 1981). HABCAP was applied to diversity units that were generally based on fourth code watersheds, varying in size from 5,000 to 20,000 acres (on the forest, fourth code watersheds vary from 714 to 650,212 acres, and DAUs vary from 230,101 to 1,269,968 acres).

The CDOW has six data analysis units (DAUs) covering lands managed by the Forest (units E6, E12, E13, E14, E15 and E16). These comprise a total of 4,108,803 acres, of which 1,842,027 acres occur on National Forest System lands. These individual data analysis units were merged with the forest's Common Vegetation Unit polygons and forest road and trail system information to develop a model that would depict availability or change in habitat effectiveness for each DAU, and by alternative (DEIS only). Data derived from forest vegetation and road layers were plugged into the HABCAP model and a progression of model runs were generated for each alternative (DEIS only) and the existing condition. The model outputs were displayed in terms of an elk habitat effectiveness index.

The forest used HABCAP to display differences among the various management alternatives being considered within the forest plan revision (DEIS only). The IBM-PC version of the HABCAP model, written in GWBASIC, was used to estimate capability at a single point in time. The current versions of the model do not have the capability of simulating habitat changes over time. However, if the link to the forest Structure Simulator Model (FSSIM) is ever completed, then the model will have the capability over time to allow for modeling of cumulative effects. Elk security blocks were identified using the vegetation and road data layer merged with the DAU management areas. The vegetation information was manipulated as follows:

- Conifer cover types were put into one data set and aspen cover types into another.
- Conifer and aspen cover types that did not meet 3C, 4A, 4B, 4C and 5 structural stage requirements were eliminated from the data sets.
- Adjacent similar cover type polygons were merged, to reduce the potential bias of applying an acreage size limitation to potential security areas. For example, if a 100-acre 3C conifer stand was next to a 150-acre 4C conifer stand, and an acreage requirement of greater than 250 acres was applied for establishing security areas, then neither polygon would be selected. In reality, in combination, these stands would indeed provide the necessary conditions to meet the security habitat. And thus, looking only at individual polygons and not their juxtaposition would result in under-estimation of the acres of security available.
- A buffer factor for open roads was applied that sets up the data to compare the various road management effects by alternative on elk security.

Recreation use trends, primarily big game hunting, were examined for effects on elk security habitat. Analysis for elk security habitat can be refined during project planning by considering topography and exact locations of timber harvest and road construction. Process limitations prevented adding topography into the analysis at the forest planning level, and likewise, at the forest planning level, locations of timber harvest and road building are only generalized.

NOTE: *Elk security was not analyzed for or presented in the FEIS because other analyses (such as patch analysis and fragmentation) present similar impacts, very little difference was identified between alternatives in the DEIS, and there is no Travel Management Plan associated with the FEIS.*

NOTE: *This was presented in the DEIS, not in the FEIS the 2002 Forest Plan direction incorporated the direction of the Lynx Conservation and Assessment Strategy, and the Forest conducted a Forest-wide viability process to identify Species of Viability Concern.*

Many have described the close relationship between habitat quality and population viability (Belovsky 1987, Shaffer 1987, Thomas 1994). Roloff and Haufler (1997) designed a process for establishing population viability planning objectives based on habitat potentials. They used a form of habitat suitability index (HSI) modeling as the assessment tool, and *Lynx canadensis* was the subject species. The Forest used this process for evaluating lynx habitat viability across the planning area.

Although most HSI modeling has been performed at the scale of the species life history requirements, the effects of spatial scale on the effectiveness of habitat is an important consideration (Van Horne and Wiens 1991, Roloff 1994). Many support the notion that HSI models should be applied to spatial scales that are biologically meaningful at the organism scale (Roloff 1994, Ruggerio et al. 1994), however there is no consistent rational associated with spatial scale and model applicability.

The basis for the habitat suitability index modeling conducted was the use of grid-based GIS technology to sample allometric home ranges across the landscape. Each grid cell represented the center of an allometric home range. The allometric area surrounding a grid cell was evaluated for structural and spatial habitat requirements, and each grid cell was assigned an HSI value. The results were a series of grid cells, each containing an HSI value that provided a spatial trend of habitat quality (Maurer 1994). HSI values were combined by 0.10 increments to form a habitat contour map for the viability analysis. The scores of the HSI values were a depiction of the within-allometric-home-range structural and spatial requirements (Roloff and Haufler 1997).

The lynx viability assessment used the same patch code designation as that set up for the fragstats analysis. **Table B-40** outlines the patch codes, species, structure codes, and habitat suitability index codes used in the lynx viability assessment. The values assigned to the patch codes were based on based on a review of the literature (snowshoe hare and lynx) and structural stage estimates for supplying hare and lynx habitat.

Table B-40
Lynx habitat suitability index values

Patch code	Species group	Structure code	Habitat suitability index
1	Douglas-fir	1	.90
2	Douglas-fir	2	.70
3	Douglas-fir	3	.50
4	Douglas-fir	4	.60
5	Douglas-fir	5	.90
6	Spruce-fir	1	.90
7	Spruce-fir	2	.70
8	Spruce-fir	3	.50
9	Spruce-fir	4	.60
10	Spruce-fir	5	.90
11	Aspen	1	.70
12	Aspen	2	.50
13	Aspen	3	.40
14	Aspen	4	.50
15	Aspen	5	.70
16	Lodgepole pine	1	.60
17	Lodgepole pine	2	.50
18	Lodgepole pine	3	.60
19	Lodgepole pine	4	.80
20	Lodgepole pine	5	.90
21	Cottonwood	All	.20
22	Piñon-juniper	All	.20
23	Barren	Not applicable	.10
24	Grass	Not applicable	.40
25	Sagebrush/rabbitbrush	Not applicable	.20
26	Shrubs	All	.40
27	Road/utility/etc.	Not applicable	.10

MANAGEMENT INDICATOR SPECIES SELECTION

NOTE: *This is the process that was used to identify MIS in the FEIS. The 1982 regulations to implement the National Forest Management Act require that Management Indicator Species (MIS) be identified as part of the forest plan.*

MIS serve multiple functions in forest planning: focusing management direction developed in the alternatives, providing a means to analyze effects on biological diversity, and serving as a reliable feedback mechanism during forest plan implementation. The latter is accomplished by monitoring population trends in relationship to habitat changes (36 CFR 219.19 (a)(6)).

Management indicator species or groups will be monitored during the life of the 2002 Plan in order to assess whether the proposed actions are achieving the desired conditions of the MIS. The selection process loosely followed the process to select MIS as presented in 'Region 2 Management Indicator Species Selection Process and Criteria, Regional Desk Guide, Chapter G, Revision Analysis Requirements for Planning Documents', pages G.27 to G.38, June 5, 2001 (administrative files). The major discussions dealt with the development of management questions based on the management issues in which the use of management indicator species may be appropriate. Initially, only those issues that were identified as management concerns in documents related to the Proposed Revised Forest and Land Management Plan (Plan) were considered. These documents were:

- White River National Forest—Analysis of the Management Situation, July 1997
- Proposed Revised Land and Resource Management Plan—White River National Forest, 2000
- Draft Environmental Impact Statement—White River National Forest, October 2000 (DEIS)
- USDA Forest Service Strategic Plan, 2000 Revision

Additional issues and questions were also developed based on specialist concerns that may not have been emphasized in the listed documents. Only those management issues/questions in which MIS may be appropriate were further considered. Other monitoring issues/questions were included in the Plan in which the use of MIS is not appropriate or is not the most efficient method to answer the questions.

After a monitoring question was developed, possible methods to answer the question were considered, which may or may not include the use of MIS. The emphasis in the selection of MIS was for those species or groups of species in which the monitoring of one or more of the population parameters would indicate the effects of management activities on the MIS and other species. Other categories of MIS (threatened, endangered, sensitive, game, special interest, etc.) were also considered as appropriate.

The species considered are those that were considered for the Forest Viability Analysis. This list is inclusive of all vertebrate species that occur or may occur on the WRNF. Only invertebrate and plant species that were considered as a concern by the Forest Service, Fish and Wildlife Service, or the Colorado Natural Heritage Program were analyzed as part of the Viability Analysis, and are the only species considered for MIS in this document.

Species-habitat relationship information was gathered from a variety of sources. The Viability Analysis documented general habitat use of most species, and specific habitat use of selected species. Various publications were also reviewed for species-habitat relationships.

First, from the documents listed above and specialist input, the important management issues, challenges and associated trends in environmental conditions were identified on the Forest. Next, monitoring priorities, questions, methods to answer questions, and possible MIS species were developed. Only those management issues and questions in which MIS may be appropriate were considered. The final issues, questions and MIS species from this list were selected to analyze (FEIS, Chapter 3, Species-level assessment; 2002 Plan, Appendix EE) and monitor (2002 Plan, Chapter 4).