TERRESTRIAL HABITAT AND WILDLIFE

The sections which follow discuss the affected environment and environmental consequences for numerous topics related to wildlife habitat. The consequences are based on full budget levels. Approximately a third less change is expected to occur at the experienced budget level but the relative ranking of alternatives remains the same unless otherwise indicated.

LEGAL AND ADMINISTRATIVE FRAMEWORK

Major laws and executive orders that provide authority to manage wildlife, fish and plant resources on the ARNF-PNG include the following: Agricultural Appropriation Act; Fish and Wildlife Coordination Act; Multiple-Use, Sustained-Yield Act; National Environmental Policy Act; Endangered Species Act, as amended; Forest and Rangeland Renewable Resources Planning Act; Federal Water Pollution Control Act; National Forest Management Act; Federal Land Policy and Management Act; Bald Eagle Protection Act; Executive Order 11990, Protection of Wetlands; and Sikes Act.

Objectives: Maintain ecosystem diversity and productivity by recovering threatened or endangered species; by maintaining at least viable populations of all native and desired nonnative wildlife, fish and plants in habitats distributed throughout their geographic range on National Forest System lands; and by producing habitat capability levels to meet sustained-yield objectives relative to demand for featured and management indicator species identified in RPA and forest plans. Provide diverse opportunities for esthetic, consumptive and scientific uses of wildlife, fish and sensitive plant resources in accordance with national, regional, state and local demands.

Policy: Serve the American people by maintaining diverse and productive wildlife, fish and sensitive plant habitats as a integral part of managing National Forest ecosystems. Maintain a partnership with state fish and wildlife agencies in habitat management efforts. Recognize the state wildlife and fish agencies as responsible for the management of animals and the Forest Service as responsible for the management of habitat. Involve other federal agencies, concerned conservations groups and individuals in activities affecting wildlife and fish as appropriate. Resolve habitat management issues, concerns and opportunities as close to the local level as possible. Specify quantitative wildlife, fish and sensitive plant habitat objectives and standards in the RPA Program, regional guides, forest plans and Sikes Act schedules. Develop a balanced program that meets goals. Use wildlife and fish habitat relationships. Give coequal consideration to wildlife and fish habitat with other resources in Forest Service programs. Involve research and other scientists in the development of strategies. Acquire habitats or adjust ownership patterns to meet wildlife, fish and plant habitat goals and objectives identified through Forest planning (*Forest Service Manual*, Washington Office Amendment 2600-91-8).

BROAD SCALE OVERVIEW

The variety of vegetation type and structure, topography, elevation and climate provides habitats for many species of animals. Vertebrates which include birds, mammals, reptiles, amphibians and fish represent the majority of animals that are known and managed for. However, invertebrates which include butterflies, moths and snails are also of concern. Certain invertebrates are discussed later in the Fine-scale section, along with vertebrates of special concern.

Almost 700 species of vertebrates are known or are likely to occur within Colorado, and almost 500 species occur within the ARNF and PNG. In the ARNF about 350 species now occur, and in the PNG 375 species are estimated to reside or spend time during migration (Tables 3.65 and 3.75). Some species are common to both forests and grassland. Fish are included for comparison with other animal species but discussed in detail in the aquatics section.

Table 3.65 Vertebrates Known or Likely in Colorado for ARNF and PNG combined, ARNF only, and PNG only, 1997.[a]

	Number of Species			
Vertebrates	Colorado	ARNFs and PNG	PNG only	ARNFs only
Birds	396	336	284	214
Mammals	129	92	46	86
Fish	108	34	17	23
Reptiles	46	25	20	20
Amphibians	18	10	8	8
TOTAL	697	497	375	351

[a] Sources: Hammerson 1982, Colorado Division of Wildlife 1994, Andrews and Righter 1992, Armstrong 1993

MANAGEMENT INDICATORS

Management indicators are selected for the Arapaho and Roosevelt National Forests according to direction in the *Rocky Mountain Regional Guide* (1992), Forest Service Manual 2600 (1991) and the Federal Register 36 CFR 219.19 (1982). Management indicator communities (MICs) for animals and plants include existing and potential old-growth forests, interior forests, young to mature forest structural stages, openings within and adjacent to forests such as alpine or foothill grass and shrublands, aspen, riparian areas, wetlands, aquatic environments and caves/mines. These MICs are used to predict changes and effects by alternative in this *FEIS*, and will be monitored and evaluated during *Forest Plan* implementation. These important habitats are

selected to predict likely effects that are identifiable, measurable and predictable by alternative, and can be related to habitat capability of associated species. Major impacts to these habitats can be estimated, and forestwide differences by alternative, if any, related to habitat changes and human disturbance can then be used to show effects on associated species.

Management indicator species (MIS) were selected by MIC that would reflect changes within those communities. In addition, federal and state endangered or threatened species known to occur on NFS lands that may be affected by management were selected as MIS (*FEIS,* Appendix G, Section G-1). The *Forest Plan* gives direction for management of MIS habitat (Chapter One) and monitoring and evaluation of MIS and habitat (Chapter Four). The *FEIS* and Appendix G (Section G-1) present estimated effects to habitat and MIS, and also discuss monitoring and evaluation.

Habitats and Agents of Change

Vegetation and travel management are the major influences on terrestrial wildlife. In order to estimate effects on wildlife and to compare alternatives, careful consideration must be given to predicting impacts of vegetation change and human disturbance. The influence of management by the different alternatives will be considered for different habitats that are important to many animals.

Important forest wildlife habitats and habitat components that can be quantified and compared among alternatives are cover, forage, forested corridors, open corridors, effective habitat, interior forests and old growth. Definitions of these habitats and estimates of how each will change are based on the conditions of vegetation, structural stages, and open roads and trails.

Vegetation and Nonvegetation Types

Each forest vegetation type is important to many different animal species. The relationship of numbers of vertebrates by group to different vegetation types varies and is summarized in Table 3.66 for the Forests. Riparian areas provide habitat for the highest number of terrestrial vertebrates, and it is also apparent that each major vegetation type is important to many different wildlife species. Nonvegetated types such as cliffs, talus and caves provide necessary habitats for numerous wildlife species as well (Thomas et al. 1979).

Table 3.66 Terrestrial Vertebrates Known or Likely by Vegetation Type, ARNF[a]

Species	Riparian	Ponderosa pine Douglas-fir	Rocky Mtn Juniper	Aspen	Lodgepole Pine	Engelmann Spruce/ Subalpine Fir
Amphibians	14	5	8	5	3	5
Reptiles	33	12	7	2	2	0
Mammals	73	62	52	39	41	38
Birds	188	132	102	95	86	76
TOTAL	308	211	169	141	132	119

[a] Source: Hoover and Wills, 1984.

Environmental Consequences—Vegetation and Nonvegetation Types

As discussed earlier under the environmental consequences for ground cover composition, little or no change is expected in vegetation or nonvegetation types. Accordingly, effects on species found within the different vegetation types (Table 3.49) are considered negligible, and no effects are expected at all on species that inhabit nonvegetated areas with any alternative.

Vegetation Structure

The numbers and kinds of animal species also vary by the structural conditions that exist within similar vegetation types and between different vegetation types. Numerous wildlife species utilize different vegetation and structural stages for feeding, reproduction and cover throughout the year (Thomas et al. 1979). Horizontal structure, consisting of a number of contiguous sites within a forested area, each with its own distinct structural stage, is considered most beneficial to mammals. Vertical structure, consisting of layered plants, canopy levels, snags and fallen logs within a site, is considered most beneficial to birds (Hoover and Wills 1984). The old-growth structural stage, the edges or ecotones between sites with distinctly different structural stages, and riparian vegetation provide the most vertically diverse habitats, and here species richness is usually high for plants and animals. Presence of early and late forest successional stages is crucial to providing habitat for all terrestrial wildlife species (Thomas et al. 1979).

Environmental Consequences—Vegetation Structure

Habitats and wildlife will be affected by changes in vegetation structure (Tables 3.67 and 3.68). Forestwide amounts of late successional forest increase or remain constant in all alternatives during decades 1 and 5. All alternatives reduce older stages in ponderosa pine somewhat by decade 5. Most changes occur in lodgepole pine, with Alternative E having most older stages and Alternative I having the fewest in decades 1 and 5.

Old growth (combined total from all major conifer types) is maintained forestwide in all alternatives in decade 1 and is increased by decade 5, except in Alternatives I and C where amounts are less than existing in both decades. Reduction of old growth occurs in only the lodgepole pine conifer type, with amounts dropping in Alternatives A, I and C. All alternatives increase old growth in the remaining conifer types (spruce-fir, poderosa pine and Douglas-fir) in decades 1 and 5.

Indications are that old-growth habitat in ponderosa pine and Douglas-fir which is presently quite limited (1 percent or less of each type) will similarly increase with any alternative. Spruce-fir old growth which is now abundant (28 percent of type) will also increase. Lodgepole pine old growth (now 8 percent of type) would be maintained or increase slightly over 50 years in three Alternatives (E, H, B) and would decrease in three Alternatives (A, I, C).

Table 3.67 Comparison of Late Successional and Old Growth Percentages in Major Forest Types by Alternative in Decades 1 and 5 with Existing Percentages Based on Full Budget Level

Late Successional-Decade 1	**Alternatives**						
Mature & Old Growth	Current	A	B	C	E	H	I
Percent of Major Forest Types	61	62	62	62	63	62	61
Percent Late Successional in LP Type	47	46	47	46	49	48	46
Percent Late Successional in SF Type	77	79	79	79	79	78	79
Percent Late Successional in PP Type	84	84	82	84	84	82	83
Percent Late Successional in DF Type	70	72	71	72	72	71	72
Late Successional-Decade 5	**Alternatives**						
Mature & Old Growth	Current	A	B	C	E	H	I
Percent of Major Forest Types	61	67	64	63	71	66	62
Percent Late Successional in LP Type	47	53	49	46	59	53	45
Percent Late Successional in SF Type	77	86	85	86	87	85	84
Percent Late Successional in PP Type	84	77	73	77	81	73	79
Percent Late Successional in DF Type	70	78	75	77	80	76	79
Old Growth-Decade 1	**Alternatives**						
	Current	A	B	C	E	H	I
Percent of Major Forest Types	12	12	12	11	12	12	11
Percent of LP OG in LP Type	8	7	8	6	8	8	7
Percent of SF OG in SF Type	28	29	29	29	29	29	29
Percent of PP OG in PP Type	1	2	2	2	2	2	2
Percent of DF OG in DF Type	<1	1	1	1	1	1	1

Old Growth-Decade 5	Alternatives						
	Current	A	B	C	E	H	I
Percent of Major Forest Types	12	13	14	11	15	14	11
Percent of LP OG in LP Type	8	6	8	3	9	9	4
Percent of SF OG in SF Type	28	33	33	33	33	33	33
Percent of PP OG in PP Type	1	4	4	4	4	4	4
Percent of DF OG in DF Type	<1	4	4	4	4	4	4

Early successional stages are increased forestwide in all alternatives, with most increase occurring in Alternative B and least in Alternative E for decades 1 and 5 (Table 3.68). During decades 1 and 5 each major conifer type maintains or increases its early stages.

The grass-forb portion of early successional stages increases forestwide in all alternatives except Alternative E in decades 1 and 5. Alternatives C, A, B and E have slightly less grass-forb stage in the spruce-fir forest type in decades 1 and 5.

Indications are that early seral forest habitat will generally increase and favor associated terrestrial wildlife with any alternative. Given that early successional stages of conifers are currently quite limited (2 percent), increases are expected to be beneficial for many species.

This will be a substantial benefit to wildlife in all alternatives but one for the following reasons: First, most early successional stage increases will occur in lodgepole pine where grasses, forbs, shrubs and seedling trees are most limited. Second, amounts of these stages in lodgepole will double, or nearly double, in all alternatives except E during decade 1, and quadruple in most alternatives (B, C, H and I), and nearly triple in Alternative A in decade 5. Only Alternative E effects no increase of early lodgepole successional changes in decade 1 and little increase (1 percent) by decade 5. In addition as discussed in the structure of vegetation section, existing amounts of early seral-stage lodgepole pine are probably below RNV.

Increases are considered most important in the upper montane where lodgepole pine predominates and nonforest openings of grasses, forbs and shrubs are most limiting. Most late- to early-successional changes are planned in lodgepole. It is less important in lower montane and subalpine forests where nonforest vegetation is most prevalent. Increases will assure that early stages are less limiting and better dispersed throughout the Forests. Most early seral habitat is provided by Alternatives B, C, H and I, followed by A and E respectively, in decade 1.

The following specific direction in the *Forest Plan* assures, along with more general direction, adequate early and late forest structural stages including old growth for terrestrial wildlife:

- Chapter One, Section One: Forestwide management emphasis goals 3 and 8 and objectives 2 and 12 for biodiversity, ecosystem health and sustainability

- Chapter One, Section Two: Operational goals, standards and guidelines 34, 41, 62, 66, 92, 93, 116-122

- Chapters Two and Three: Geographic and management area direction that emphasizes wildlife habitat .

Table 3.68 Comparison of Early Successional and Grass-Forb Percentages in Major Forest Types by Alternative in Decades 1 and 5 with Existing Percentages Based on Full Budget Level

Early Successional-Decade 1	**Alternatives**						
Grass-forb, Shrub-seed	Current	A	B	C	E	H	I
Percent of Major Forest Types	2	4	5	5	3	5	5
Percent Early Successional in LP Type	3	6	6	6	3	5	7
Percent Early Successional in SF Type	1	1	1	1	1	2	2
Percent Early Successional in PP Type	2	4	7	4	4	7	4
Percent Early Successional in DF Type	1	4	6	4	4	6	4
Early Successional-Decade 5	**Alternatives**						
Grass-forb, Shrub-seed	Current	A	B	C	E	H	I
Percent of Major Forest Types	2	8	13	11	5	11	11
Percent Early Successional in LP Type	3	8	14	14	4	12	15
Percent Early Successional in SF Type	1	2	2	2	1	3	3
Percent Early Successional in PP Type	2	15	22	15	12	22	13
Percent Early Successional in DF Type	1	13	22	13	11	20	12
Grass-Forb-Decade 1	**Alternatives**						
	Current	A	B	C	E	H	I
Percent of Major Forest Types	1	3	3	3	1	3	3
Percent Grass-forb in LP Type	1	4	4	4	1	3	5
Percent Grass-forb in SF Type	1	<1	<1	<1	<1	1	1
Percent Grass-forb in PP Type	1	3	5	3	3	6	3
Percent Grass-forb in DF Type	1	3	5	3	3	5	3
Grass-Forb-Decade 5	**Alternatives**						
	Current	A	B	C	E	H	I
Percent of Major Forest Types	1	2	3	3	1	3	3
Percent Grass-forb in LP Type	1	2	3	4	1	3	3
Percent Grass-forb in SF Type	1	<1	<1	<1	<1	1	2
Percent Grass-forb in PP Type	1	3	5	3	3	6	3
Percent Grass-forb in DF Type	1	3	5	3	3	5	3

Forage and Cover

Relationships of terrestrial wildlife species, habitat needs, and forest ecosystems and structure are described by Hoover and Wills (1984) and by Thomas et al. (1979). Forage and cover are primary welfare factors for terrestrial wildlife that are affected by management and use of National Forest System lands. Forage and cover are provided for the most part by the vegetation and structural stages described already. Vegetation provides forage directly in such forms as grasses, forbs, shrubs, leaves, twigs, bark, shoots and sprouts for herbivores.

Vegetation also provides food indirectly by harboring such animal life as worms, insects, rodents and birds that are preyed upon by carnivores.

Cover is important in many different ways, and the type of cover necessary for different wildlife species varies. Cover types include escapement, reproduction, resting and loafing, sleeping or roosting, climatic protection, travel, and cover for special needs such as hibernation or molting (Hoover and Wills, 1984). Vegetation and structure provide cover in various forms from the forest floor to tree tops, and at all levels in between.

The amounts, arrangement, and condition of forage and cover influence habitat availability and capability. In addition, the amount of human disturbance may limit the usefulness of otherwise available habitat for certain wildlife species, especially during times of concentration, reproduction and rearing of young (Knight and Gutzwiller 1995).

Environmental Consequences—Forage and Cover

As just noted, forage and cover requirements vary from one species of wildlife to another. To describe differences by alternative, either individual species or groups of species with similar needs, such as guilds or life forms, would need to be identified and their habitat needs related to vegetation and structure. Using forage and cover needs to estimate the habitat capability for numerous species (Hoover and Wills 1984; HABCAP 1990) is more successful at scales within the ARNF (generally sixth-level watersheds of 20,000 acres or less) than forestwide. However, project and watershed-specific estimates are not practical for forestwide planning and this level of detail is not considered necessary to assess overall forestwide changes.

Instead, important coarse-scale considerations can be applied. First is whether a full range of habitat conditions will be provided over time. The preceding analysis of environmental consequences for cover types and vegetation structure indicates that some of every cover type and vegetation structure combination will be provided by all alternatives through five decades. While certain alternatives increase limited habitats (e.g., ponderosa pine old growth and grass-forb stages) and other alternatives reduce habitats to limited amounts (i.e., lodgepole pine old growth), all alternatives will provide forage and cover for existing species. Other environmental- consequence sections discuss coarse- and fine-scale habitats in relation to forage, cover and other welfare factors. It is not meaningful to compare and rank alternatives solely based on forage and cover.

The following specific direction in the *Forest Plan* assures, along with more general direction, adequate forage and cover for terrestrial wildlife species:

- Chapter One, Section Two: Forestwide operational goals, standards and guidelines 56, 65, 66, 69, 71, 82-84, 92-95, 98, 166

- Chapters Two and Three: geographic and management area direction that emphasizes wildlife habitat

Forested Corridors

Forested corridors maintain the connectedness of relatively dense conifers (see definition in *FEIS* Appendix B). These are important to many forest-dwelling wildlife species such as marten, pine and Abert's squirrels, lynx and southern red-backed vole.

Forested corridors exist on 60 percent of the entire Arapaho and Roosevelt National Forests. Given that the amount of intermediate and late seral conifers is high (98 percent of total forest acres, Table 3.50); that lodgepole pine, which accounts for half of all forest types, is apparently above RNV in terms of these stages; and that conditions within these stages provide forested corridors, it is estimated that the forestwide forested corridor amount of 60 percent is above RNV. Within individual geographic areas amounts range from 18 to 95 percent. The geographic area with least coverage is Redfeather in low-elevation, ponderosa pine and Douglas-fir forests on the east slope of the Continental Divide, and the highest coverage is Tabernash in high-elevation, lodgepole pine forests on the west slope. Forests are generally well connected throughout the ARNF (Fig 3.11). The status of forested corridors is not known for many of the non-National Forest System lands within the boundaries of the Forest; however Rocky Mountain National Park which is mostly surrounded by these Forests appears to be similar.

Environmental Consequences—Forested Corridors

Based on predicted forest growth, timber harvest, wildfire, fire management treatments (Tables 3.59 through 3.64) and precommercial thinning (See the section on effects on timber resources from timber management), the changes to forested corridors in decade 1 vary little among alternatives and existing amounts are reduced little. Forested corridor estimates are 59 percent in Alternative E and 58 percent in remaining alternatives in decade 1. By decade 5, forested corridors will be reduced more and differences among alternatives will vary more. Ranked in order of forested corridor amounts are Alternatives E (58 percent), A (55 percent), C, H, I (53 percent) and B (52 percent).

The effects on wildlife that tends to travel and live in medium to dense overstory conifers would vary by placement, size and shape of treatment areas. However in all alternatives, the maintenance of functioning corridors is directed through goals, standards and guidelines even though the total amount may be reduced. Forested corridors can be substantially reduced in amount and still fulfill their function; they will remain generally well in excess of the minimum

100 meter width (Figure 3.11). The following specific direction from the *Forest Plan* assures, along with more general direction, adequate forested corridors for terrestrial wildlife species:

- Chapter One, Section Two: Operational goals, standards and guidelines 40, 42, 68, 94-97, 101, 105, 121

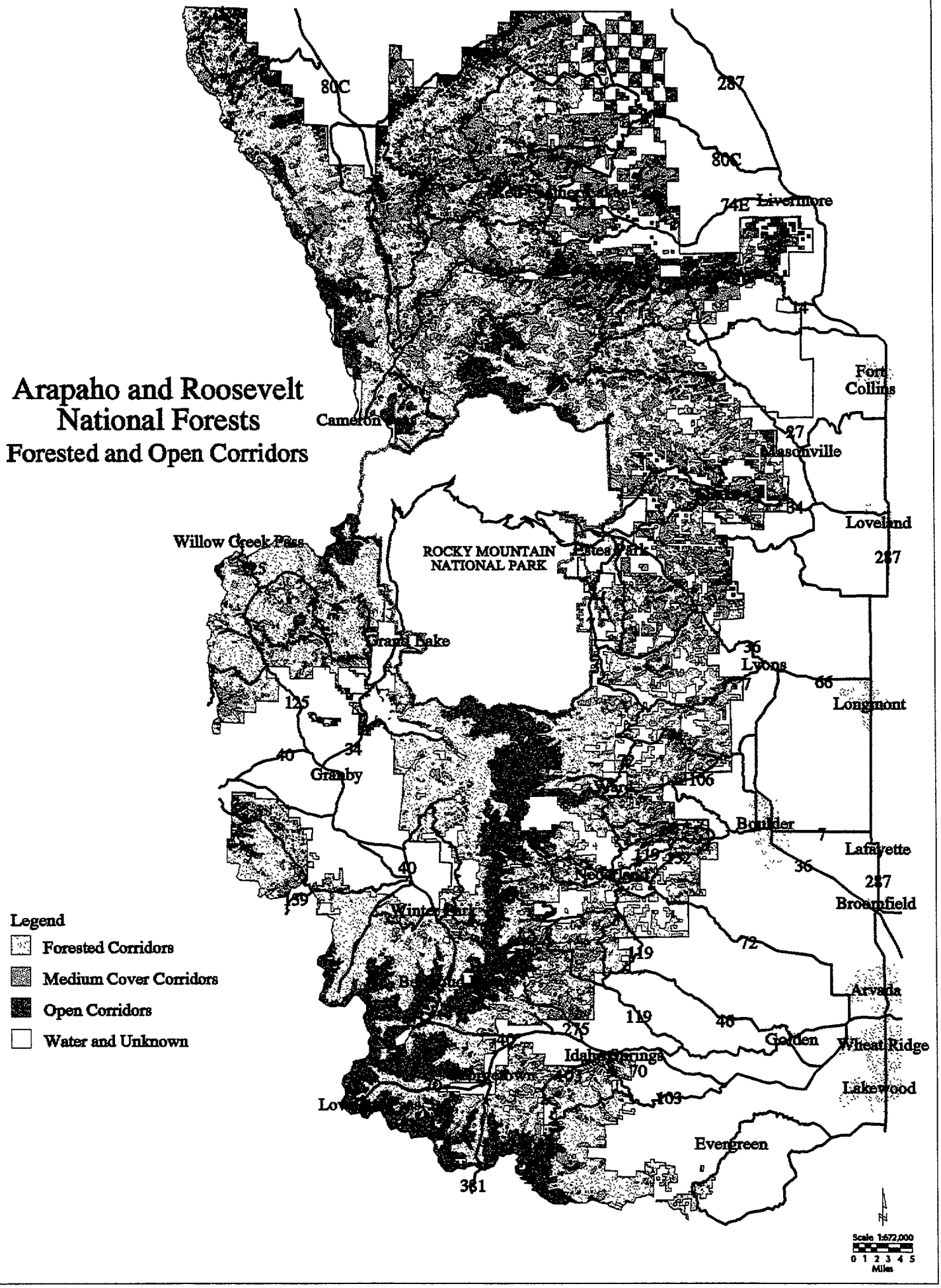
- Chapters Two and Three: Geographic and management area direction that emphasizes wildlife habitat

Open Corridors

Open corridors maintain the connectedness of open areas that are either nonforested or nonvegetated; they do not, however, refer to water passages. They are important to species such as bighorn sheep that require openness, generally away from forested vegetation. Bighorns dwell in nonforested areas and require nonforest vegetation for forage, especially grass and forbs. They are stressed if they cannot see for distances and will pioneer into unfamiliar habitat only through relatively open landscapes.

Open corridors, which must be at least 100 meters wide, exist on 21 percent of the entire ARNF. Given that the grass-forb, shrub-seedling stages of forest is low (2 percent of total forest acres, as shown on Table 3.50); that lodgepole pine, which accounts for half of all forest types, is, as noted earlier, apparently below RNV in terms of these stages; and that conditions within these stages provide open corridors in addition to shrublands, grasslands and rock, it is therefore estimated that the forestwide open corridor amount of 21 percent is below RNV. Within individual geographic areas amounts range from about 1 percent to 56 percent. The geographic area with the least proportion of openness is Evergreen near the south end of the Forest, and the highest areas are the Indian Peaks Wilderness and James Peak geographical areas straddling the Continental Divide. Well connected and abundant openings occur in relatively few areas throughout the ARNF (Figure 3.11). The status of open corridors is not known for most of the non-National Forest System lands within the boundaries of the Forest; however, Rocky Mountain National Park which is mostly surrounded by these Forests appears to be similar.

Figure 3.11


Arapaho and Roosevelt
National Forests
Forested and Open Corridors
Legend
Forested Corridors
Medium Cover Corridors
Open Corridors
Water and Unknown
ROCKY MOUNTAIN
NATIONAL PARK
Estes Park
Cameron
Willow Creek Pass
Grand Lake
Granby
Winter Park
Idaho Springs
Fort
Collins
Masonville
Loveland
Lyons
Longmont
Boulder
Lafayette
Broomfield
Arvada
Golden
Wheat Ridge
Lakewood
Evergreen
80C
287
74E
Livermore
125
34
40
119
72
275
70
103
361
Scale 1:572,000
0 1 2 3 4 5
Miles

Environmental Consequences—Open Corridors

Based on predicted forest growth, timber harvest, wildfire, fire management treatments (Tables 3.59 through 3.64) and precommercial thinning discussed in the Timber Production Section, (subsection Effects on Timber Resources from Timber Management) the changes to open corridors in decade 1 vary little among the six alternatives, and existing amounts will increase little, if any. Maximum estimates of open corridors for Alternatives B, C, and I are 23 percent, for Alternatives A and H 22 percent, and for Alternative E 21 percent in decade 1. By decade 5, open corridors will increase and differences among alternatives will vary more. Ranked in order of maximum open corridor amounts are Alternatives B and I (28 percent), Alternatives C and H (27 percent), Alternative A (25 percent) and Alternative E (23 percent). These are considered maximum percentages because not all grass-forb, shrub-seedling stages will provide open corridor conditions (see Appendix B to this *FEIS*). Created openings would need to be properly placed to increase open corridors. Alternatives that emphasize wildlife habitat needs, with forest treatments specifically designed to increase open corridors, would tend to effect the most substantial improvement in localized situations. Therefore, alternatives with the most acreage in Management Areas 1.41, 1.42, and 3.5 are estimated to increase open corridors where needed and best benefit wildlife. Alternatives B, A, H (in order, high to low) are expected to improve open corridors the most, followed by Alternatives C and I (similar), and Alternative E.

The significance is that open corridors can be substantially improved locally while still providing adequate forested travel corridors (see preceeding Forested Corridors discussion and Figure 3.11). The following specific direction in the *Forest Plan* assures, along with more general direction, adequate open corridors for terrestrial wildlife species:

- Chapter One, Section Two: Operational goals, standards, and guidelines 40, 62, 66, 71, 76, 92-94

- Chapters Two and Three: Geographic and management area direction that emphasizes wildlife habitat

Habitat Effectiveness

Effective habitat is considered to be mostly undisturbed habitat which is buffered from regularly used roads and trails, both motorized and nonmotorized. Numerous species are disturbed by human activities at least during certain times of the year and as a result cannot effectively utilize otherwise available habitat (Knight and Gutzwiller 1995).

Effective habitat is estimated to exist on about 67 percent of the ARNF. Amounts of effective habitat range from 39 to 95 percent by geographic area, as shown on the *forest habitat effectiveness map included with the Forest Plan* and in Appendix B. The geographic area with the least proportion is Mammoth which is a small area with interspersed landownership, development and high road densities near population centers of the Front Range. The highest habitat effectiveness occurs in the Neota Wilderness.

On National Forest System lands, the overall reduction of habitat effectiveness by 33 percent (from 100 percent to 67 percent) is due primarily to use of travelways by motorized vehicles (26 percent) and to a lesser degree by nonmotorized use (7 percent). The 2,300 miles of roads and more than 840 miles of trails which are open to public use are equivalent to 1.2 miles of road and 0.4 miles of trail for each square mile of forest. Most travelways are outside of wilderness areas and have average miles per square mile densities of 1.2 for roads and 0.3 for trails. In wilderness trail density is 0.8 miles per square mile. Of the 59 geographic areas, 19 (32 percent) have travelway densities exceeding 2.0 and seven (12 percent) have travelway densities exceeding 3.0.

The RNV was at 100 percent habitat effectiveness prior to humans. One-third of the ARNF is now relatively disturbed by human influences on its originally undisturbed condition. Road densities of 2.0 miles per square mile or less are generally recommended as acceptable for certain wildlife habitats, especially for elk, while densities approaching 3.0 or more are generally not recommended (Holbrook and Vaughan 1985, Lipscomb et al. 1984, Lyon and Ward 1982, Lyon 1983 and 1979).

On non-NFS lands within the boundaries of the Forest, effective habitat is estimated to occur on 32 percent of the area and ranges from 2 to 100 percent within different geographic areas. Travelways open to use, mostly roads, are estimated to total about 1,800 miles at an average density of 3.9 miles per square mile.

On all lands combined within the boundaries of the ARNF effective habitat is about 60 percent of the total area. Total roads and trails open to use are estimated at over 5,000 miles, with an overall average density of 2.0 miles per square mile, which is just at the threshold of unacceptability for certain species. The substantially higher travelway densities on non-NFS lands within Forest boundaries raises average travelway densities for the combined lands above what is generally recommended for wildlife in numerous areas. Since densities are generally low on NFS lands, their importance in providing effective habitat is substantial.

Environmental Consequences—Habitat Effectiveness

Management of roads and trails open to public use (regardless of jurisdiction), new motorized (OHV) trails, nonmotorized trails and new timber roads expected to remain open to public use on NFS lands during the decade are considered determinants of habitat effectiveness among the six alternatives. Open travelways are reduced and habitat effectiveness is increased in all alternatives and at both budget levels during decade 1 (Tables 3.69 and 3.70). Considering both budget levels, Alternative H provides the highest habitat effectiveness, followed by Alternative B; the remaining alternatives are all similar.

Table 3.69 Forestwide Changes in Roads and Trails Open to Public Use on National Forest System Lands and Habitat Effectiveness by Alternative in Decade 1 at Full Budget Level

	Alternatives						
	Now	**A**	**B**	**C**	**E**	**H**	**I**
Travelway Miles	3,165	2,882	2,755	2,803	2,901	2,519	2,842
Travelway Density (mi/sq mi)	1.6	1.4	1.4	1.4	1.4	1.3	1.4
Habitat Effectiveness (percent)	67	71	72	71	70	74	71

Table 3.70. Forestwide Changes in Roads and Trails Open to Public Use on National Forest System Lands and Habitat Effectiveness by Alternative in Decade 1 at Experienced Budget Level

	Alternatives						
	Now	**A**	**B**	**C**	**E**	**H**	**I**
Travelway Miles	3,165	3,079	2,875	3,022	3,040	2,735	3,026
Travelway Density (mi/sq mi)	1.6	1.5	1.4	1.5	1.5	1.4	1.5
Habitat Effectiveness (percent)	67	69	71	69	69	72	69

The environmental significance of the next decade of planning is that all alternatives will substantially improve local habitats, reverse the forestwide trend of increasing travelways and decreasing habitat effectiveness which has brought travelway mileage to historically high levels and habitat effectiveness to historically low levels. While approaching RNV is not possible, the trend toward it will begin. Increased development on intermingled or adjacent non-NFS lands is expected in the future, and reducing open travelways on NFS lands will help to maintain habitat effectiveness within Forest boundaries.

The following specific *Forest Plan* direction assures, along with more general direction, effective habitat for terrestrial wildlife species:

- Chapter One, Section One: Forestwide management emphasis objective 1 for biodiversity, ecosystem health and sustainability
- Chapter One, Section Two: Operational goals, standards and guidelines 39, 94, 95, 98, 100-109, 120
- Chapters Two and Three: Geographic and management area direction that favors effective habitat

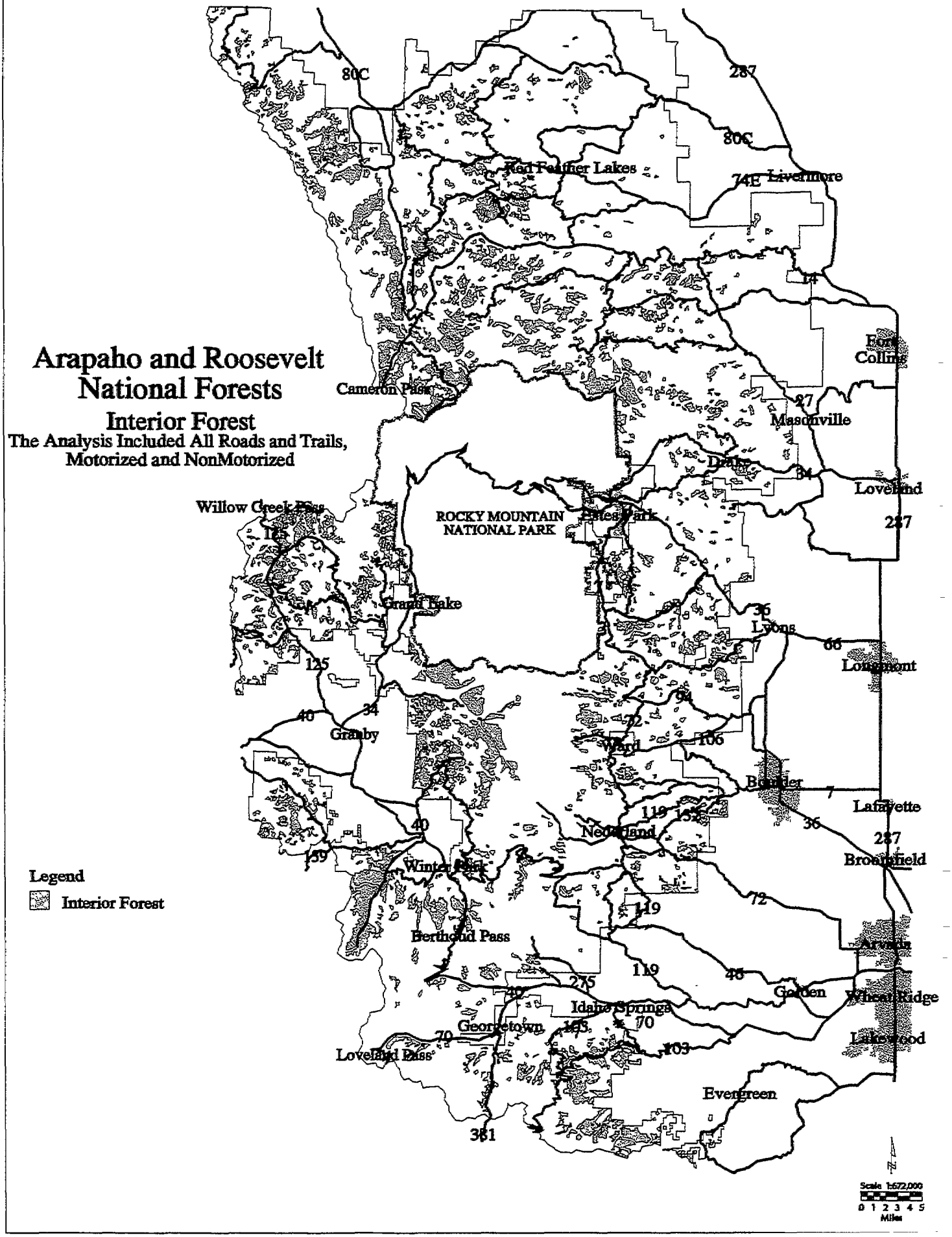
Interior Forests

Interior forests are considered to be contiguous areas of relatively dense and large trees that are buffered from the temperature, light and humidity differences of sizable forest openings, and also from human disturbances along regularly used roads and trails. Interior forests occur exclusively within effective habitat but are smaller in area because they are free from the influence of adjacent openings.

Interior forest habitat is considered important in the Rocky Mountains, but it differs in many respects from interior forests often described for the eastern and northwestern states (Grumbine 1992, Harris 1984, Hunter 1990, Morrison et al. 1992). In general, human-induced disturbances are the primary causes of fragmentation in the east and northwest, and both human and other natural disturbance are substantial in the Rockies (USDA Forest Service 1992). Within the ARNF, however, fragmentation of the forested canopy occurs or has historically occurred even without human influence due to substantial amounts of nonforest cover, (grass, shrubs, rock, ice, bare soill, lakes and ponds) and nonhuman caused disturbances (fire, insects, disease, windstorms, landslides).

Interior forests are estimated to exist on 15 percent of the ARNF (Figure 3.12), with amounts per geographic area ranging from 0 to 41 percent. The geographic area with the lowest proportion is Mammoth, which is a small area with interspersed landownership, development and high road densities near population centers of the Front Range. The highest proportion of interior forest occurs in the Tabernash geographic area within a vast lodgepole pine forest .

Figure 3.12


Arapaho and Roosevelt National Forests
Interior Forest
The Analysis Included All Roads and Trails, Motorized and NonMotorized
Legend
Interior Forest
ROCKY MOUNTAIN NATIONAL PARK
Red Feather Lakes
Cameron Pass
Willow Creek Pass
Grand Lake
Granby
Berthoud Pass
Loveland Pass
Georgetown
Idaho Springs
Nederland
Boulder
Lafayette
Broomfield
Golden
Wheat Ridge
Lakewood
Evergreen
Arvada
Longmont
Lyons
Loveland
Fort Collins
Estes Park
Scale 1:672,000
0 1 2 3 4 5
Miles

Discussions of the RNVs of other elements that relate to interior forests such as the structure of vegetation, old-growth forests, forested corridors, open corridors and habitat effectiveness, suggest that the amount of late structural stage component that defines interior forest is high but that its reduction by human influences is also high. About 193,700 acres, or 15 percent of the total ARNF area, exists as interior forest in spite of human influence. Another 436,100 acres of late successional forest with greater than 40 percent crown closure (Table 3.58), or about 34 percent of the total ARNF area, would be interior forest in the absence of human influence.

Human influence on interior forests appears important in several ways to the range of natural variation. Fire suppression has probably increased the extent of interior forest by decreasing the number of openings in certain areas and increasing or extending the existence of stands with large, dense trees, especially in lodgepole pine areas. Timber harvest has probably counterbalanced the effects of fire suppression in lodgepole pine to some extent but has contributed to decreased amounts of interior forests in Douglas-fir, ponderosa pine and spruce-fir. Human presence and activities have fragmented and reduced interior forests, especially where recent timber harvest has been concentrated (Figure 3.10) and in the urban intermix areas along the eastern edge of the Forests.

It may also be reasonable to assume that the situation now existing in high-elevation wilderness areas is within the original RNV that existed prior to human use. While human influences have affected wilderness areas to some extent, the degree of influence has generally been low in contrast to other NFS lands, especially for forest structural stages. Using this assumption, comparisons can be made for spruce-fir and lodgepole forests. Spruce-fir in high-elevation wilderness contains about 23 percent interior forest (not including human disturbance along trails) while lodgepole forests outside of wilderness and subject to human disturbance contain only about 13 percent interior forest. If the assumption is generally accurate, even though not precise, these comparisons indicate downward trends in amounts of interior forest outside of wilderness since human arrival.

Therefore, while forestwide RNV is not known for interior forests, it is estimated that interior forests are near the low end of RNV where most timber management has occurred (Figure 3.10), below RNV where most human disturbance now occurs (especially in urban intermix areas), and within RNV elsewhere.

Environmental Consequences —Interior Forests

Based on amounts of late successional forest (Tables 3.59-3.64 and 3.67), habitat effectiveness (Tables 3.69 and 3.70), and interior forest within suitable and available timber areas (Figure 3.12 and the *timber suitability maps*) only small changes in interior forests are expected in all alternatives. Alternatives B and H will maintain or slightly increase current levels of interior forest and reverse the forestwide trend to date of decreasing interior forests to their presently low levels. The remaining alternatives will bring about small to moderate decreases in interior forests in decade 1. While the increases brought by Alternatives B and H will be small in the first decade, wildlife species closely associated with or dependent on habitat elements of interior forests will benefit. The alternatives that decrease interior forest amounts are estimated to have

minor to moderately adverse effects on interior forest wildlife. Wildlife species which are closely associated with or dependent on habitat elements of interior forest include marten, black bear, western flycatcher, brown creeper, golden-crowned kinglet, ruby-crowned kinglet, hermit thrush, three-toed woodpecker and boreal owl.

The following specific *Forest Plan* direction assures, along with more general direction, adequate interior forests for terrestrial wildlife species:

- Chapter One, Section Two: Forestwide operational goals, standards and guidelines 39-41, 71, 92-93

- Chapters Two and Three: Geographic and management area direction that favors interior forests

Environmental Consequences to Terrestrial Habitat and Wildlife from Management of Other Resources

Like previous estimates, the effects described below relate to the forestwide scale. Local effects would generally be more intense. Site-specific habitat concerns will be dealt with using the goals, standards and guidelines in forestwide and management area direction itemized in the *Forest Plan.*

Environmental Consequences—Minerals Management

The effects of extracting salable and locatable minerals should disturb less than 50 acres of land over the whole ARNF and are estimated to be negligible in all alternatives for the next 10 years.

Effects from extracting leasable minerals, particularly oil and gas, are estimated to be minor as well, and should not substantially affect habitat or wildlife. Surface disturbance to available habitat will be minor. New roads will generally be closed to public use and necessary traffic limited. In addition to forestwide and management area direction, standard lease terms and supplemental stipulations are available where needed for local resource mitigation. Alternative H would cause no adverse habitat modification, and adverse effects in decade 1 from Alternatives A, B, C, E and I would be similar.

Environmental Consequences—Ski Areas

Expansions of existing ski areas or development of new ski areas would convert forests to grass-forb-shrub stages, reduce habitat amount due to roads and facilities, reduce habitat effectiveness, and likely decrease interior forests. Changes are likely to be permanent and will influence habitats and wildlife beyond the area of expansion and development. New sites, presently not impacted by development, would probably cause adverse effects to larger areas than would expansion of existing sites that are already impacting habitat. Effects to habitat and wildlife will be adverse, primarily through human disturbance and habitat loss from roads and

facilities. In decade 1 most habitat will remain available to wildlife in Alternative H, followed by B, C, E, I and A in descending order, with C and E equal.

Environmental Consequences—Utility Corridors

Expansion or development of corridors could potentially reduce habitat effectiveness, interior forest and old growth and adversely affect wildlife. Loss of habitat effectiveness might be mitigated if new, open travelways do not result from corridor expansion or development. However, reductions of interior forest and old growth could be permanent, depending on the location and maintenance of corridors. Since plans for expansion or development are not predicted and do not vary by alternative, potential effects are the same in all alternatives.

Environmental Consequences—Range

Grazing livestock occupy space, consume or trample vegetation that provide habitat for various wildlife species and consequently affect certain habitats and wildlife. Direct competition between hoofed animals such as cattle and elk is sometimes alleged, but is not known to be a problem. Trampling of bird nests affects individual birds or pairs, but effects on whole avian populations are not identified as significant. Concentrated livestock use in riparian areas that removes vegetation, exposes soil, inhibits regeneration of otherwise natural vegetation, promotes weeds and accelerates erosion of soil into streams can occur in localized situations but in general is not common. Grazing is permitted on less than 9 percent of Forest acres with any alternative. Thus, although livestock grazing affects terrestrial wildlife habitat and may cause localized adverse effects, it is generally not known to be adverse at the levels and amounts being considered. The potential to affect habitat is highest in Alternatives A, C, and I, followed by Alternatives B and E, and lowest in Alternative H based on the level of grazing (animal unit months) and number of allotments open to grazing.

The following specific *Forest Plan* direction assures, along with more general direction, that grazing will be compatible with terrestrial habitat and wildlife:

- Chapter One, Section Two: Forestwide operational goals, standards and guidelines 35, 36, 80-91, 97

- Chapters Two and Three: Geographic and management area direction that emphasizes grazing to benefit wildlife habitat

Cumulative Effects

Summary of Environmental Consequences—Terrestrial Habitat and Wildlife—Broad Scale

The following table compares different wildlife habitats and values, but is similar to comparing apples with oranges. It can be used to see relative differences among alternatives at a glance for habitats previously discussed in detail. It can also be used, along with background information presented earlier, to better understand cumulative effects.

Table 3.71 Summary of Amounts of Wildlife Habitats and Components by Alternative in Decade 1 At Full Budget Level[a]

Habitats/Components	Alternatives
	←Most----------Acres----------Least→
Vegetation and Nonvegetation Types	No substantial difference by alternative
Vegetation Structure	
Late Successional Forest	E | A, B, C, H | I
Old Growth Forest	A, B, E, H | C, I
Early Successional Forest	B, C, H, I | A | E
Grass-forb	A, B, C, H, I | E
Forage and Cover	←---------- NA ----------→
Forested Corridors	E | A | C, H, I | B
Open Corridors	B | A | H | C, I | E
Habitat Effectiveness	H | B | A, C, E, I
Interior Forests	B, H | A, C, E, I
Habitat Remaining Considering Effects from Management of:	
Minerals	H | A, B, C, E, I
Ski Areas	H | B | C, E | I | A
Utility Corridors	No substantial difference by alternative
Livestock Grazing	H | B, E, A, C, I

[a] Alternatives grouped in single boxes yield similar numbers of acres.

FINE SCALE OVERVIEW

There are plant species, communities, habitat types and seral or structural components within the large-scale array of plant communities described in the broad-scale overview that are important components to the overall health and functioning of the system. These elements require specific attention since the broad-scale evaluation may not be sensitive to, or indicative of, conditions at smaller scales.

PROPOSED, ENDANGERED, THREATENED AND SENSITIVE (PETS) PLANTS AND ANIMALS

The ARNF contains numerous species that are relatively rare, unique and/or whose viability is of concern. Species presently identified of most concern include those federally listed by the U.S. Fish and Wildlife Service as endangered or threatened or proposed, as well as species listed in the Rocky Mountain Region by the Forest Service as sensitive. These proposed, endangered, threatened and sensitive (PETS) species include the State of Colorado species listed as endangered or threatened that occur or are likely to be affected by activities or events on National Forest System lands (Appendix G).

A total of 54 animals and 19 plants are PETS species presently known or likely to occur within NFS lands or to be impacted by Forest Service management actions (Table 3.72). There are other PETS species that are not known to exist where they have historically occurred, including the gray wolf, grizzly bear and black-footed ferret. The list of PETS species is dynamic, but a current list is presented in Appendix G.

Table 3.72 Numbers by Class of Proposed, Endangered, Threatened and Sensitive Species that Occur, Likely Occur or May be Impacted on Arapaho and Roosevelt National Forests

	Proposed	Endangered	Threatened	Sensitive	Total
Birds		4	2	22	28
Mammals	1			7	8
Amphibians				4	4
Reptiles				1	1
Fish		4	1	4	9
Invertebrates		1	0	3	4
Plants		0	2	17	19
TOTAL	1	9	5	58	73

UNIQUE HABITATS AND COMMUNITIES

There are other plant and animal species listed as rare and numerous natural plant communities listed as significant by the Colorado Natural Heritage Program (CNHP). Like other lists, this list is dynamic and changes as new information becomes available. Communities and species presently listed by CNHP as occurring within the Forests are presented in Appendix G.

Riparian habitat is vital to many forms of life, limited in amount, and dispersed throughout the Forests. It is discussed in the Aquatic and Riparian Section.

VIABILITY ASSESSMENT

Issues concerning biodiversity are often focused on fine-scale habitats, species and communities, since these elements are typically limited in abundance and/or are susceptible to change.

Habitat is essential to species needs, but viability cannot be provided entirely by habitat management. Populations fluctuate for many reasons other than habitat conditions, especially in the short term. For example, amphibian populations have declined throughout the western United States over the past decade from causes apparently beyond local habitat conditions. Accordingly, Forest Service management of habitat on National Forest Systems lands is coordinated with species population management by the Colorado Division of Wildlife and the U.S. Fish and Wildlife Service.

As discussed in the broad scale section, vegetation and travel management are major influences on habitat. The Forests are currently in a position of maximum flexibility for options with desired vegetation structural conditions. Almost 60 percent of all types of forested land is late successional and less than about 2 percent is early successional (Table 3.50). In the conifer types most likely to be managed (lodgepole pine, spruce-fir, ponderosa pine and Douglas-fir) the percent of late successional forest is slightly higher, at 61 percent (Table 3.67). Management of trees can only take structural stages rapidly in one direction: from larger and older to smaller and younger trees. Later stages can be preserved or quickly converted to early stages, as appropriate. With either situation the old-growth forests, that once lost are irreplaceable for long periods of time, can be maintained in ample amounts and at desired locations.

In all alternatives, late successional conifers will change little from their existing status in decade 1. Within late successional conifers, the old-growth component varies somewhat among alternatives but is estimated to be adequate for viability concerns in all alternatives in decade 1. The amount and distribution of lodgepole pine old growth may be a concern with Alternatives A, and especially C and I by decade 5. The extremely low amounts of ponderosa pine and Douglas-fir old growth that presently exist are predicted to increase in all alternatives (Table 3.67).

Early forest successional stages will increase in all alternatives (Table 3.68) due to timber harvest, wildfire and fire management treatments Assuming that associated habitat change could pose some risk to fine-scale elements, the risk to viability from vegetation structural changes is

least in Alternative E followed in descending order by A, B, H, C and I in decade 1, with the last four all similar.

Miles of open travelways and resultant habitat effectiveness vary by alternative, with all improving the habitat effectiveness that currently exists (Tables 3.69 and 3.70). The risk of human disturbance to habitat viability is least in Alternative H, followed in descending order by B, A, C, I and E in decade 1 at both budget levels.

Sensitive management of fine-scale species, habitats, communities, and other resources or uses that may cause effects is required to assure that fine-scale elements will continue to exist and function. It is therefore necessary to focus on site-specific details during implementation of the *Forest Plan*. There are ecological and biological goals, objectives, standards and guidelines for *Forest Plan* implementation that apply to each alternative. This direction is meant to insure that management of resources and resource uses will assure viability for all species and communities, especially those at greatest risk. In addition to Forest-level direction, further site-specific assessment and design are required for each proposed project or activity. Monitoring and evaluation of *Forest Plan* implementation will show if planned measures are adequate or if new measures need to be adopted to better assure viability. *Forest Plan* amendments can be made to change direction if necessary.

No single species, habitat or community is known to be dependent on only the Arapaho and Roosevelt National Forests. Relatively little change in overall conditions are predicted to occur in Forest landscapes, and large portions will remain in undeveloped and undisturbed condition through decade 5 in any alternative. Analysis of threatened, endangered and sensitive species locations in relation to management areas by alternative indicates that potential conflicts can likely be avoided.

Considering the habitat needs of PETS it is apparent that any species could potentially be affected by implementation of any alternative (Appendices H and I). Effects are generally expected to be beneficial or benign, based on the design of the *Forest Plan* and the estimated effects in this *FEIS;* they will, however, be further addressed locally prior to project implementation. Each alternative will, at a minimum, maintain the viability of species and the existence of habitats and communities.

The following specific *Forest Plan* direction assures, along with more general direction, viability of PETS species and other rare species and communities:

- Chapter One, Section One: Forestwide management emphasis goal 4 and objective 3 for biodiversity, ecosystem health and sustainability
- Chapter One, Section Two: Operational goals, standards, and guidelines 44-48, 53, 86, 91-93, 165, 166
- Chapters Two and Three: Geographic and management area direction that emphasizes wildlife habitat

POTENTIAL FOR WOLF REINTRODUCTION

There is interest and concern in the potential reintroduction of the gray wolf to Colorado. This issue is beyond the scope of any single *Forest Plan* and beyond the authority of the Forest Service to decide. It is appropriate, however, to address how *Forest Plan* alternatives may affect the potential for possible reintroduction of wolves.

A feasibility study completed by the U.S. Fish and Wildlife Service (Bennett 1994) concluded that most of the Arapaho and Roosevelt National Forests are not suitable for wolf reintroduction. The portions east of the Continental Divide are excluded because of high human population density.

While population and travelway densities are generally lower west of the Continental Divide, year-long recreation is relatively high. Accordingly the likelihood of human interactions, conflicts and disturbance is high. The relatively high potential for human-wolf conflicts is estimated to increase with any alternative as human populations increase in close proximity, especially along the Front Range.

The potential for successful reintroduction is probably proportional to the amount of effective habitat provided by alternative (Table 3.69). However, differences among alternatives may be insignificant for such a wide-ranging species and may be already overshadowed by the high and increasing amount of human recreation and by the existing and predicted density of travelways (Mech et al. 1988 and Thiel 1985).

LYNX AND WOLVERINE

There is considerable interest in habitat potential and viability for forest carnivores in general, and for lynx and wolverine in particular. At present both species are Forest Service, Rocky Mountain Region sensitive species. It is possible that these species could become federally listed as threatened or endangered. In May 1997 listing was warranted for lynx but was precluded by higher priority actions to amend the list the U.S. Fish and Wildlife Service (*Federal Register*: May 27, 1997).

Major viability issues for lynx include direct human threat, forage and cover habitat conditions. Human access into lynx habitat during winter can cause increased poaching opportunities, especially when lynx tracks can be detected by traversing vast forest areas in a short period of time. Adequate food consists primarily of snowshoe hare populations, and adequate cover generally consists of relatively connected overhead conifer forest canopies. As already noted, all alternatives will increase habitat effectiveness by reducing travelways open to the public; all will increase early successional lodgepole pine and in turn increase snowshoe hare habitat; all will retain ample forested corridors, and *Forest Plan* direction is designed to restore, protect and enhance sensitive species habitat and population viability.

The building of new roads for timber management may result in more routes that are accessed during winter. These routes could potentially be used for snowmobiling (an efficient mode of

travel for traversing vast areas) even if new roads are designated as closed to motorized public travel. In all alternatives the majority of new timber management roads will be built in the vicinity of past timber management activities and existing roads, thereby not impacting presently unroaded areas of potential lynx habitat. Alternatives A and C would least assure that public motorized winter travel does not increase, since timber roading into unroaded areas would be noticeably higher than in the remaining alternatives. Nevertheless, both the intent and the expected result of implementing any alternative will be to maintain or improve lynx habitat and viability, with best assurance in Alternatives B, E, H and I.

For the wolverine, further human intrusion on habitat is probably the primary threat within this already "urbanized" Forest. The wolverine is a species suited to vast undisturbed areas. Threats to habitat effectiveness for wolverine include motorized and nonmotorized travel, especially in forested and alpine ecosystems where use is presently low. All alternatives will, however, increase habitat effectiveness, and *Forest Plan* direction is designed to provide habitat for viable populations of sensitive species. Both the intent and the expected result of implementing any alternative will be to maintain or improve wolverine habitat and viability. Considering estimates of both habitat effectiveness and expected roading into unroaded areas for timber management, Alternatives H and B should best assure wolverine viability, followed by Alternatives E and I, and lastly by Alternatives A and C.

PLAINS

ECOLOGICAL SECTION

A part of province 331, the Pawnee National Grassland is entirely in the Central High Plains Section, 331H. This area covers about 23,300 square miles, 8.0 percent of the province and 0.6 percent of the United States. The section is generally characterized as moderately dissected rolling plains with potential natural vegetation being blue grama and buffalo grass. Elevations range from 3,610 to 5,905 feet, rivers and streams are few, and major human uses affecting natural vegetation are agriculture and range (USDA Forest Service 1994).

PAWNEE NATIONAL GRASSLAND

Pattern of Vegetation

Short-grass prairie of mostly buffalo-grass and blue grama predominates on the PNG. This high plains region is east of the Front Range at elevations of about 5,000 to 6,000 feet. Low moisture often limits vegetation growth and the growing season is about 140 days per year.

Other ownerships within and around the Grassland are dominated by cultivated wheat and native shortgrass prairie. Much of the northern boundary of the Grassland is contiguous with the shortgrass prairie of southern Wyoming. On the southwest edge most of the adjacent land has been plowed into wheat, and the western boundaries are separated from the foothills of the

Forests by small communities and farming. The eastern boundaries contain a mixture of plowed and native prairie sections that lead to the mixed-grass prairies and wooded draws of Nebraska. Within the administrative boundary, the Grassland ecosystems are dissected by roads and fences as a result of checkerboard landownership. The vegetation reflects this with visible contrasts between summer and winter livestock ranges, different stocking levels, and plowed versus native prairie.

Disturbances, Processes, and Functions

Eastern Colorado was obtained from France as part of the Louisiana Purchase in 1803. In the middle of the nineteenth century, many groups crossed the plains but did not settle the region because it lacked trees and water. Nomadic Indian tribes, who depended on bison for food, were the only permanent inhabitants until 1860. The agricultural development of the plains area began in the 1860s when numerous small farms were established. During this period small livestock operations started and by 1870 bison were largely eliminated from the plains and most of the nomadic Indians were moved to reservations. Large herds of cattle moved northward from Texas in the late 1870s and a range livestock industry was established on the plains. By the early 1880s, nearly all the land where water was available was being grazed by cattle. The livestock industry began to decline in 1886 because of severe winter weather and low livestock prices. However, almost all the native rangeland of the plains has continued to be grazed by livestock from the 1880s to the present time.

A few homesteaders began dryland farming on the plains beginning in the late 1870s and their numbers increased through the 1880s. Settlement of the plains continued at a slow rate until the beginning of World War I. During and following the war there was a great demand for wheat, and many acres of native rangeland were plowed and planted to wheat. During the 1930s the combination of drought and the Great Depression resulted in the abandonment of many of the dryland farms. The Pawnee National Grassland resulted from the purchase of many of these abandoned homesteads by the U.S. Government. Approximately 40 percent of the PNG was plowed prior to purchase. The plowed lands were reseeded with crested wheat in the 1930s and 40s, and rehabilitated.

The Grassland is an altered, seminatural landscape whose structure, processes and functions have been changed from presettlement conditions during the past 150 years by pervasive livestock grazing, fire suppression, agriculture, invasion of exotic plants, animal control and hunting. Fire was probably a key factor in the rotation of historical animal use on the prairies. The existing biological diversity is a result of the interplay of these factors and stochastic events that have acted on presettlement conditions. Fragmentation of the landscape has resulted and is perhaps most dramatic in the riparian areas and draws. The upland is less fragmented and covers approximately 80 percent of the Grassland; if vegetated its condition changes much more slowly.

Composition of Ground Cover

The PNG is part of the true shortgrass type of the northern and central plains. The moderately dense, shortgrass cover is dominated largely by two grasses, blue grama and buffalo grass.

However, a great many other plants occur from time to time, and the floristic composition varies from year to year and among different locations. Species composition of the shortgrass type is a function of latitude, altitude, weather, soil conditions, topography, and disturbance. The presence of other species generally can be explained by local climatic, physiographic, soil textural, or soil moisture differences. In swales, and after a sequence of wetter than average years, midgrasses such as western wheatgrass are often dominant because of the more favorable moisture regimes. Where prairie dogs or badgers have burrowed the forbs are more dominant. Plants in breaks along road rights-of-way are generally exotic. The major shrub component is fourwing saltbush, but trees, while present, are not a major component of the Grassland. Land cover types are itemized in Figure 3.7. Bluffs, buttes and rock outcrops are interspersed throughout the vegetation of the PNG.

Table 3.73 Existing Land Cover of the Pawnee National Grassland

	Acres (Approximate)	Percent
Grasses and Forbs	181,400	94
Shrubs	10,000	5
Woody Draws	1,000	<1
Trees	<100	<1
TOTAL	192,500	100

Environmental Consequences—Composition of Ground Cover

The existing acreages of vegetation shown above are expected to change little over time with any *Forest Plan* alternative, as are the amounts of interspersed nonvegetation cover. No conversions of one vegetation type to another will occur, but shifts in seral and climax species within habitats will vary among alternatives at both budget levels. Potential shifts are estimated to be within RNV, with change gradual and probably detectable only over centuries.

Structure of Vegetation on the Grassland

The shortgrass prairie is a complex interactive system of processes and attributes, including herbivory, insect infestation, arid climate cycles and local relief that in many cases appear subtle but, when combined, bring about the representation and distribution of successional stages for each type of plant association. Structure has been changed from presettlement conditions during the past 150 years by pervasive livestock grazing, fire suppression, and agricultural use. Within the past 80 years homesteading has had the greatest effect on successional structural stage. Approximately 77,000 acres were plowed during the homestead period from 1900 through 1939. Vegetation structure on the PNG is summarized in Table 3.74.

Table 3.74 Structure of Vegetation on Pawnee National Grassland

Vegetation Type/Structure	Acres	Percent of Type Total	Percent of Vegetation Total
Grass-forb			
Shortgrass High Structure	0	0	0
Shortgrass Medium Structure	12,400	8	6
Shortgrass Low Structure	141,100	92	73
SUBTOTAL	153,500	100	79
Midgrass High Structure	3,300	12	2
Midgrass Medium Structure	5,000	18	3
Midgrass Low Structure	19,200	70	10
SUBTOTAL	27,500	100	15
Shrub			
High Structure	1,000	10	<1
Medium Structure	1,500	15	1
Low Structure	7,800	75	4
SUBTOTAL	10,300	100	5
Woody Draws			
High Structure	1,000	83	<1
Medium Structure	200	17	<1
Low Structure	0	0	
SUBTOTAL	1,200	100	1
TOTAL	192,500		100

The previously cultivated cropland, now in transition to native grasses, is included in the above acreages. Current inventories do not allow disaggregation of these acres into a separate category however. The RNV for grassland vegetation structural stages is not known. However, the majority of the PNG which is currently in the low vegetation structural stage is estimated to approximate conditions prior to human influence.

Environmental Consequences—Structure of Vegetation

Under Alternatives A, C, E, and I the emphasis on structure is to manage for midgrasses with low structure. Livestock grazing will remain generally the same as it has been for the past 30 years, and vegetation structure will remain similar to current conditions. There may be a shift from high structure to medium structure in the midgrass areas of the Grassland.

Under alternatives B and H the emphasis on structure is to manage for approximately 10 to 15 percent more medium and high structure in midgrasses over the next 50 years. Changes in livestock management would occur to achieve the shift in structure (see Rangeland Section) and would depend on the level of grazing fees, set by Congress but not necessarily related to *Forest Plan* budget levels. Adjustments in grazing fees would permit more intensive grazing systems.

The following section discusses the affected environment and estimated effects to terrestrial habitat and wildlife. Also refer to the Rangeland Section concerning livestock grazing and other discussion.

TERRESTRIAL HABITAT AND WILDLIFE

BROAD SCALE OVERVIEW

The prairie of the Pawnee National Grassland offers an array of habitat types that support a wide variety of wildlife and fish species, as shown in Table 3.75. Fish are included for comparison with other animal species but were discussed in detail in the aquatics section. Many of the specialized and unique habitat types support endemic species with narrow habitat requirements. As these habitat types are converted to other land uses on lands of other ownership, the PNG becomes increasingly important in providing a stable land base with suitable habitat for supporting viable populations of some species. Management of the PNG alone cannot, however, insure viable populations of wildlife species. Factors responsible for population declines exist on other lands throughout the range of many species, particularly migratory species such as the mountain plover that depend on other seasonal habitats.

Table 3.75 Vertebrates Known or Likely in Pawnee National Grassland, 1997

Vertebrates	Number of Species	
	Colorado	PNG
Birds	396	284
Mammals	129	46
Fish	108	17
Reptiles	46	20
Amphibians	18	8
TOTAL	697	375

MANAGEMENT INDICATORS

Management indicators are selected for the Pawnee National Grassland according to direction in the *Rocky Mountain Regional Guide* (USDA Forest Service 1992), Forest Service Manual 2600 (1991) and the Federal Register 36 CFR 219.19 (1982). Management Indicator Communities (MICs) for animals and plants include shortgrass prairie, midgrass prairie, prairie dog towns, riparian areas, wetlands, aquatic environments, and prairie woodlands. These MICs are used to predict changes and effects by alternative in this *FEIS* and will be monitored and evaluated during *Forest Plan* implementation. These important habitats are selected to predict likely effects that are identifiable, measurable and predictable by alternative, and can be related to habitat capability of associated species. Major impacts to these habitats can be estimated, and differences by alternative, if any, related to habitat changes and human disturbance can then be used to show effects on associated species.

Management indicator species (MIS) were selected by MIC that would reflect changes within those communities. In addition, federal and state endangered or threatened species known to occur on NFS lands that may be affected by management were selected as MIS (*FEIS,* Appendix G, Section G-1). The *Forest Plan* gives direction for management of MIS habitat (Chapter One) and monitoring and evaluation of MIS and habitat (Chapter Four). The *FEIS* and Appendix G (Section G-1) present estimated effects to habitat and MIS, and also discuss monitoring and evaluation.

HABITATS AND AGENTS OF CHANGE

Vegetation and travel management are the major influences on terrestrial wildlife. In order to estimate effects on wildlife and to compare alternatives, the predicted impacts of vegetation change and human disturbance are given primary consideration. The influence of different management alternatives will be considered for different habitats that are important to many animals.

Important forest wildlife habitats and habitat components that can be quantified and compared among alternatives are cover, forage and effective habitat. Definitions of these existing habitats and of how each will change are based on the conditions of vegetation, their structural stages, and open roads and trails.

Vegetation and Nonvegetation Types

The Grassland vegetation types are important to various animal species. Riparian areas provide habitat to the high number of terrestrial vertebrates, and each major vegetation type is important to different wildlife species. Interspersed nonvegetation features such as bluffs, buttes and rock outcrops provide necessary habitats for numerous wildlife species as well (USDA Forest Service 1994).

Environmental Consequences - Vegetation and Nonvegetation Types

As discussed earlier in the section on environmental consequences of ground cover composition, little or no change is expected in vegetation or nonvegetation types. Accordingly, effects on wildlife species are considered negligible with any of the six alternatives due to changes in cover composition.

Vegetation Structure

The numbers and kinds of animal species also vary by the structural conditions that exist within similar vegetation types and between different vegetation types.

Environmental Consequences—Vegetation Structure

As discussed earlier in the section on environmental consequences of structure of vegetation, low vegetation structure will be emphasized in Alternatives A, C, E and I. Accordingly, this would maximize certain animal species that respond well to low-profile vegetation such as McCown's longspur, mountain plover and deer mice. Alternatives B and H would provide 10 to 15 percent more medium and high structure in midgrasses over 50 years and increase habitat for animals oriented to high-profile vegetation such as Baird's sparrow, Cassin's sparrow, lark bunting, Sprague's pipit, cottontail rabbits, black-tailed jack rabbits and western harvest mouse (USDA Forest Service 1994b).

Alternative B and H would provide the most structurally diverse habitats for the most wildlife; Alternatives A, C, E and I would provide the least, and would remain similar to current conditions.

The following specific *Forest Plan* direction assures, along with more general direction, vegetational structural stages for terrestrial wildlife:

- Chapter One, Section One: Grasslandwide management emphasis goal 8 and objective 12 for biodiversity, ecosystem health and sustainability

- Chapter One, Section Two: Operational goals, standards and guidelines 34-46, 41, 43, 92, 93

- Chapter Three: Management area direction that favors effective habitat

Forage and Cover

Forage and cover are primary welfare factors for terrestrial wildlife that are affected by management and use of National Forest System lands. Forage and cover are provided for the most part by the vegetation and structural stages described previously.

Environmental Consequences—Forage and Cover

As discussed under the same subject in the Forests section, forage and cover requirements vary from one species of wildlife to another. An important coarse- scale consideration at the Grassland-wide level is whether a full range of habitat conditions will be provided over time. The preceding analysis of environmental consequences for cover types and vegetation structure indicates that some of every cover type and vegetation structure combination will be provided by all alternatives. However, forage and cover changes are directly related to vegetation structural changes and wildlife responses to those changes depend on their orientation to low versus medium- to high-profile vegetation.

The following specific *Forest Plan* direction assures, along with more general direction, adequate forage and cover for terrestrial wildlife species:

- Chapter One, Section Two: Operational goals, standards and guidelines 34, 35, 80, 82-84, 98, 166

- Chapter Three: Management area direction that favors effective habitat

Habitat Effectiveness

Effective habitat is considered to be mostly undisturbed habitat, buffered from regularly used roads and trails (both motorized and nonmotorized). Effective habitat is estimated to exist on about 60 percent of the Pawnee National Grassland (see the *grassland habitat effectiveness map* included with the *Forest Plan* and Appendix B). Amounts of effective habitat range from 53 percent in the eastern half (Pawnee area) to 67 percent in the western half (Crow Valley area). Crow Valley has the largest and most contiguous tracts of National Forest System lands, and the Pawnee half has the smallest and least contiguous tracts.

On National Forest System (NFS) lands, the overall reduction of habitat effectiveness by 40 percent (from a 100 percent RNV to 60 percent) is almost totally due to the use of travelways by motorized vehicles. About 340 miles of roads and less than 2 miles of trails which are open to public use equate to mile-per-square-mile densities of 1.1 for roads and 0.0 for trails.

On non-National Forest System lands within the boundaries of the Grassland, effective habitat is estimated to occur on only 47 percent of the area and is essentially the same percent in the Pawnee and Crow Valley areas. Here travelways open to use, all of which are roads, are estimated to total more than 1,600 miles with an average density of 1.8 miles per square mile.

On all lands combined within the boundaries of the PNG, effective habitat is about 51 percent of the total area. Total roads and trails open to use are estimated at 1,950 miles with an overall density of 1.6 miles per square mile. Since densities are relatively lower on NFS lands, the importance of those lands in providing effective habitat is substantial.

Environmental Consequences—Habitat Effectiveness

Changes in amounts and locations of open roads and trails vary by alternative and will influence habitat effectiveness. Management of existing roads and trails, new nonmotorized trails and new motorized OHV routes during decade 1 are considered determinants of habitat effectiveness among alternatives.

Table 3.76 Comparison of Grassland Changes in Roads and Trails Open to Public Use on National Forest System Lands and Habitat Effectiveness by Alternative in Decade 1 at Full Budget Level

	Alternatives						
	Current	**A**	**B**	**C**	**E**	**H**	**I**
Travelway Miles	343	344	328	344	344	283	344
Travelway Density (mi/sq mi)	1.1	1.1	1.1	1.1	1.1	0.9	1.1
Habitat Effectiveness (percent)	60	60	62	60	60	67	60

Table 3.77 Comparison of Grassland Changes in Roads and Trails Open to Public Use on National Forest System Lands and Habitat Effectiveness by Alternative in Decade 1 at Experienced Budget Level

	Alternatives						
	Current	**A**	**B**	**C**	**E**	**H**	**I**
Travelway Miles	343	343	327	343	343	283	343
Travelway Density (mi/sq mi)	1.1	1.1	1.1	1.1	1.1	0.9	1.1
Habitat Effectiveness (percent)	60	60	62	60	60	67	60

Open travelways are reduced and habitat effectiveness is increased in two alternatives and maintained in four alternatives at both budget levels during decade 1 (Tables 3.69 and 3.70). Alternative H provides the highest habitat effectiveness, followed by Alternative B, and the remaining alternatives retain current conditions.

The data make clear that all alternatives will at least maintain present habitat effectiveness, reversing the forestwide trend of increasing travelways and decreasing habitat effectiveness to historically high and low levels, respectively. While approaching RNV with little or no human influence is not possible, the trend away from RNV will stop. Increased development on intermingled or adjacent non-NFS lands is expected in the future and maintained or reduced open travelways on NFS lands will help to preserve habitat effectiveness within overall Grassland boundaries.

The following specific *Forest Plan* direction assures, along with more general direction, effective habitat for terrestrial wildlife species:

- Chapter One, Section One: Grasslandwide management emphasis objective 1 for biodiversity, ecosystem health and sustainability
- Chapter One, Section Two: Operational goals, standards and guidelines 39, 95, 96, 98, 100, 101, 103, 107-109, 183
- Chapter Three: Management area direction that favors effective habitat

Environmental Consequences to Terrestrial Habitat and Wildlife from Management of Other Resources

Like previous estimates, the effects described below relate to the whole Grassland scale. Local effects would generally be more intense. Site-specific habitat concerns will be dealt with using the goals, standards and guidelines in forestwide and management area direction itemized in the *Forest Plan.*

Environmental Consequences—Minerals Management

The effects from extracting salable minerals should disturb about 5 acres of land over the whole PNG and are estimated to be negligible in all alternatives for the next 10 years.

Effects from extracting leasable minerals, particularly oil and gas, are estimated to be minor as well, and should not substantially affect habitat or wildlife. Surface disturbance to available habitat will be minor. New roads will generally be closed to public use and necessary traffic limited. In addition to forestwide and management area direction, standard lease terms and supplemental stipulations are available where needed for local resource mitigation. Alternative H would cause the least change and A, B, C, E and I would cause similar adverse habitat modification in the next 10 years; there is no substantial difference, however, among any of the alternatives.

Environmental Consequences—Utility Corridors

Expansion or development of corridors could adversely affect wildlife habitat, but would be mitigated if new, open travelways do not result. Since plans for expansion or development are not predicted and do not vary by alternative, potential effects are the same in all alternatives.

Cumulative Effects

Summary of Environmental Consequences—Terrestrial Habitat and Wildlife—Broad Scale

The following table compares different wildlife habitats and values, but is similar to comparing apples with oranges. It can be used to see relative differences among alternatives at a glance for habitats previously discussed in detail. It can also be used, along with background information presented earlier to better understand cumulative effects.

Table 3.78 Summary of Wildlife Habitats and Components by Alternative in Decade 1 At Full Budget Level[a]

Habitats/Components	Alternatives		
	←Most----------Acres----------Least→		
Vegetation and Nonvegetation Types	No substantial difference by alternative		
Vegetation Structure			
Diversity of Grass Heights	B, H	A, C, E, I	
Forage and Cover	←---------- NA ----------→		
Habitat Effectiveness	H	B	A, C, E, I
Habitat Remaining Considering Effects from Management of:			
Minerals	No substantial difference by alternative		
Utility Corridors	No substantial difference by alternative		

[a] Alternatives grouped in single boxes yield similar numbers of acres.

Fine Scale Overview

There are plant species, communities, habitat types and seral or structural components within the large-scale array of plant communities described in the broad-scale overview that are important components to the overall health and functioning of the system. These elements require specific attention since the broader, coarse- scale evaluation is not sensitive to, or indicative of, conditions at these smaller scales.

Proposed, Endangered, Threatened and Sensitive (PETS) Plants and Animals

The Pawnee National Grassland contains numerous species that are relatively rare, unique and/or whose viability is of concern. Species presently identified of most concern include those federally listed as endangered, threatened, or proposed; as well as species listed in the Rocky Mountain Region by the Forest Service as sensitive. These proposed, endangered, threatened and sensitive (PETS) species include the State of Colorado species listed as endangered or threatened that occur or are likely to be affected by activities or events on National Forest System lands (Appendix G).

A total of 35 PETS animals and plants are presently known or likely to occur within NFS lands or to be impacted by Forest Service management actions (Table 3.79). There are other PETS species that are probably no longer present where they have historically occurred, including the buffalo, gray wolf, grizzly bear and black-footed ferret. The list of PETS species is dynamic, but a current list, along with status, state and global rarity, is given in Appendix G.

Table 3.79 Numbers by Class of Proposed, Threatened, Endangered and Sensitive Species that Occur, Likely Occur or May be Impacted on Pawnee National Grassland

	Proposed	Endangered	Threatened	Sensitive	Total
Birds		3	1	19	23
Mammals				4	4
Amphibians				2	2
Reptiles				1	1
Fish				1	1
Invertebrates				3	3
Plants				1	1
TOTAL	0	3	1	31	35

Unique Habitats and Communities

There are other plant and animal species listed as rare and numerous natural plant communities listed as significant by the Colorado Natural Heritage Program (CNHP). Like other lists, this list is dynamic and changes as new information becomes available. Communities and species presently listed by CNHP as occurring within the Forests are presented in Appendix G.

Riparian habitat is vital to many forms of life, limited in amount, and dispersed throughout the Grassland. It is discussed in the Aquatic and Riparian Section.

Viability Assessment

Issues concerning biodiversity are often focused on fine-scale habitats, species and communities, since these elements are typically limited in abundance and/or are susceptible to change.

Habitat is essential to species needs, but viability cannot be provided entirely by habitat management. Populations fluctuate for many reasons other than habitat conditions, especially in the short term. For example, amphibian populations have declined throughout the western United States over the past decade from causes apparently beyond local habitat conditions. Accordingly, Forest Service management of habitat on National Forest Systems lands is coordinated with species population management by the Colorado Division of Wildlife and the U.S. Fish and Wildlife Service.

Miles of open travelways and resultant habitat effectiveness vary by alternative, with all improving the habitat effectiveness that currently exists (Tables 3.76 and 3.77). Since disturbed habitat subjects viability to greater risk than undisturbed habitat, the risk from human disturbance is least in Alternative H followed by Alternative B, and is greatest in Alternatives A, C, E, and I which are all similar in decade 1 at both budget levels.

For the same reasons discussed in the viability assessment section for the Forests, it is estimated that each alternative will at a minimum maintain the viability of species and existence of habitats and communities.

The following specific *Forest Plan* direction assures, along with more general direction, viability of PETS species and other rare species and communities:

- Chapter One, Section One: Forestwide management emphasis goal 4 and objective 3 for biodiversity, ecosystem health and sustainability
- Chapter One, Section Two: Operational goals, standards and guidelines 44-51, 53, 91-93, 165, 166
- Chapter Three: Management area direction that emphasizes wildlife habitat