APPENDIX G

MANAGEMENT INDICATOR SPECIES ANALYSIS AND RARE SPECIES LISTS

SECTION ONE - ANALYSIS OF MANAGEMENT INDICATOR SPECIES (MIS)

I. Introduction

A A requirement of the National Forest Management Act (as described in the implementing regulations at 36 CFR 219 19) is that fish and wildlife habitats on National Forest System lands be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area The planning area for this analysis consists of the Arapaho and Roosevelt National Forests and Pawnee National Grassland (ARNF/PNG). Provision of habitat to support, at least, a minimum of reproductive individuals of those species is a requirement Because of the diversity of habitat on the ARNF/PNG, a wide variety of management indicator species (MIS) could be identified to fulfill this requirement. We have tiered our analysis of management indicator species to a community-based analysis of habitats displayed in detail in the *FEIS*.

Management indicator communities identified for the Arapaho and Roosevelt National Forests are·

* Existing and potential old-growth forests (OG)
* Interior forests (IF)
* Young to mature forest structural stages (YM)
* Openings within/adjacent to forests (O)
* Aspen forests (A)
* Montane riparian areas and wetlands (MRW)
* Montane aquatic environments (MAQ)

Specialized habitat types identified for the Arapaho and Roosevelt National Forests are·

* Caves/Mines (CM)

Management indicator communities identified for the Pawnee National Grassland are

* Shortgrass prairie (SP)
* Midgrass prairie (MP)
* Prairie dog towns (PD)
* Prairie riparian areas and wetlands (PRW)
* Prairie aquatic environments (PAQ)

Specialized habitat types identified for the Pawnee National Grassland are

* Prairie Woodlands (PW)

B Legal and Administrative Framework: 36 CFR 219.19 directs consideration of fish and wildlife resources during land and resource management planning. This appendix, in combination with information presented in the revised *Plan* itself, the *FEIS*, Appendices H and I (Biological Assessment and Evaluation), identifies selected management indicator species and discloses potential for effects on MIS habitats and populations

II. Management Indicator Species Selection

A Species Selected MIS were selected that were believed to be characteristic of the management indicator communities and that would reflect changes in condition within those communities. Threatened, endangered, sensitive or otherwise rare species were considered for selection Common species with limiting life stages that occur on the forests or grasslands were also considered, as were common species of widespread interest for hunting or wildlife viewing If this process did not identify an appropriate management indicator species, one was selected from the group of species common to the community. Indicator species were selected to reflect each of the following communities present on the forests and grassland as described in the *FEIS*. In addition, federal and state endangered or threatened species known to occur on NFS lands that may be affected by land and resource management (Appendix H - Biological Evaluation of Sensitive Species, Appendix I - Biological Assessment of Endangered and Threatened Species) where selected regardless of fit to management indicator communities

Arapaho and Roosevelt National Forests Management Indicator Communities and Indicator Species

- Existing and Potential Old Growth Forest.
  - Northern three-toed woodpecker
  - Flammulated owl
  - Pygmy nuthatch
- Interior Forest
  - Black bear
  - Golden-crowned kinglet
- Young to Mature Forest Structural Stages:
  - Elk
  - Mule deer
  - Hairy woodpecker
- Openings Within/Adjacent to Forest
  - Elk
  - Mule deer
  - Bighorn sheep
  - Mountain bluebird
- Aspen Forest
  - Warbling vireo
- Montane Riparian Areas and Wetlands
  - Wilson's warbler
  - Northern leopard frog
  - Boreal toad

Montane Aquatic Environments·
- Greenback cutthroat trout
- Colorado River cutthroat trout
- Brook Trout
- Brown Trout
- Rainbow Trout

Arapaho and Roosevelt National Forests Special Habitat Community and Indicator Species
Caves/Mines:
- Townsend's big-eared bat

Pawnee National Grassland Management Indicator Communities and Species.
Shortgrass Prairie:
- Ferruginous hawk
- Mountain plover

Midgrass Prairie:
- Ferruginous hawk
- Lark bunting

Prairie Dog Towns.
- Prairie dog
- Western burrowing owl

Prairie Riparian Areas and Wetlands
- Northern leopard frog

Prairie Aquatic Environments·
- Plains topminnow
- Plains killifish

Pawnee National Grassland Special Habitat Community and Indicator Species:
Prairie Woodlands:
- Mule deer
- Brown thrasher

Federal and State Endangered or Threatened Species Known to Occur on National Forest System Lands that may be Affected by Land and Resource Management (species not already selected for management indicator communities)
- American peregrine falcon
- bald eagle
- wolverine
- river otter
- lynx
- wood frog

B MIS Species List

Management indicator species selected to represent communities on the ARNF/PNG are displayed in the following table.

Table G 1 Management Indicator Species on the ARNF and PNG.

SPECIES	MIS ARNF	MIS PNG	STATUS*	COMMUNITY**
MAMMALS				
Elk	X			YM/O
Mule deer	X	X		YM/O/PW
Bighorn sheep	X			O
Black bear	X			IF
Prairie dog		X		PD
Townsend's big-eared bat	X		S	CM
wolverine	X		S, e	
river otter	X		S, e	
lynx	X		S, e	
BIRDS				
Flammulated owl	X		S	OG
Mountain bluebird	X			O
Golden-crowned kinglet	X		S	IF
Three-toed woodpecker	X		S	OG
Hairy woodpecker	X			YM
Pygmy nuthatch	X		S	OG
Warbling vireo	X			A
Wilson's warbler	X			MRW
Ferruginous hawk		X	S	SP/MP
Mountain plover		X	S	SP
Brown thrasher		X		PW
Lark bunting		X		MP
Western burrowing owl		X	S	PD
American peregrine falcon	X	X	E, t	

Bald eagle	X	X	T, t	
AMPHIBIANS				
Boreal toad	X		S, e	MRW
Northern leopard frog	X	X	S	MRW/PRW
Wood frog	X		S, t	
FISH				
Greenback cutthroat trout	X		T, t	MAQ
Colorado River cutthroat trout	X		S	MAQ
Brook trout	X			MAQ
Brown trout	X			MAQ
Rainbow trout	X			MAQ
Plains topminnow		X	S	PAQ
Plains killifish		X		PAQ

* E = federal endangered, T = federal threatened; S = Forest Service Sensitive, e = state endangered, t = state threatened

** Community codes explained in section I,A

C Species Considered But Not Selected:

As directed in 36 CFR 219.19 a(1) endangered, threatened plant and animal species identified on state and federal lists for the planning area were considered as MIS Endangered and threatened species not known to occur within the planning unit were not selected However those species are still important for management, mitigation, and monitoring For instance, distribution of Preble's jumping mouse, a newly proposed species, will be inventoried in conjunction with efforts by other federal, state, and private interests Recovery efforts for Preble's would be monitored as part of the Forest's monitoring and evaluation activities (see Chapter Four - *Forest Plan*) Likewise, rare species will be inventoried and protected through project level input to planning In summary, MIS status is not the only determinant of whether and how a species will be managed and monitored. Ongoing Forest Plan monitoring; site specific project planning, mitigation, and monitoring; and cooperation with other agencies also result in management emphasis

Table G.2 Species Considered but Not Selected on the ARNF and PNG.

SPECIES	OCCURRENCE		REASON NOT SELECTED
	ARNF	PNG	
MAMMALS			
Black-footed ferret			Currently no known occurrence on the Forest or Grassland
Rocky Mountain gray wolf			Currently no known occurrence on the Forest or Grassland
Swift fox		X	Mountain plover is selected in lieu of because it is more sensitive to changes in the shortgrass prairie condition
Grizzly bear			Currently no known occurrence on the Forest or Grassland
Dwarf shrew	X	X	Generally not vulnerable to expected changes in habitat
Pygmy shrew	X		Habitat generalist
Preble's meadow jumping mouse			Currently no known occurrence on the Forest or Grassland
Ringtail	X		Rare and species information limited on Forest
Marten	X		Other indicator species selected to cover similar community characteristics and species information limited on Forest
Fringed-tail myotis		X	Currently no known occurrence on the Grassland
BIRDS			
Least tern			Does not occur within the planning area
Piping plover			Does not occur within the planning area
Eskimo curlew			Does not occur within the planning area
Whooping crane			Does not occur within the planning area
Mexican spotted owl			Currently no known occurrence on the Forest or Grassland
Boreal owl	X		Other indicator species selected to cover similar community characteristics
Common loon	X	X	Limited habitat on the Forest and Grassland
Northern goshawk	X		Other indicator species selected to cover similar community characteristics
Osprey	X	X	Limited and seasonal occurrence
Merlin	X	X	Effects of management practices difficult to assess
American bittern	X		Rare, during migration
White-faced ibis	X	X	Uncommon on the Forest and Grassland
Sandhill crane	X		Pass-over migrant, uncommon on the Forest

SPECIES	OCCURRENCE		REASON NOT SELECTED
	ARNF	PNG	
Long-billed curlew	X	X	Uncommon on the Forest and Grassland
Upland sandpiper		X	Uncommon on the Grassland
Black tern	X	X	Uncommon on the Forest and Grassland
Lweis' woodpecker	X		Other indicator species selected to cover similar community characteristics
Olive-sided flycatcher	X	X	Other indicator species selected to cover similar community characteristics
Baird's sparrow		X	Rare migrant on Grassland
Loggerhead shrike		X	Other indicator species selected to cover similar community characteristics
Fox sparrow	X	X	Uncommon on Forest Rare migrant on Grassland
Purple martin	X	X	Populations in planning area small and scattered
Western yellow-billed cuckoo		X	Uncommon on the Grassland
AMPHIBIANS			
Tiger salamander	X	X	Disturbance tolerant Other species selected as indicators to cover similar community characteristics
REPTILES			
Lined snake	X		Rare on Forest
Yellow mud turtle		X	Limited occurrence, only one observation on Grassland
FISH			
Bonytail chub			Occur in mainstem Colorado River downstream from Forest
Colorado squawfish			Occur in mainstem Colorado River downstream from Forest
Humpback chub			Occur in mainstem Colorado River downstream from Forest
Razonback sucker			Occur in mainstem Colorado River downstream from Forest
Flathead chub			Currently not known to occur on Forests or Grassland
Banded killifish			Currently not known to occur on Forests or Grassland
INVERTEBRATES			
American buring bettle			Currently not known to occur in the planning area

SPECIES	OCCURRENCE		REASON NOT SELECTED
	ARNF	PNG	
Pawnee montane skipper			Currently not known to occur in the planning area
Lost ethmid moth	X		Habitat data for Forest and Grassland unavailable
Steven's tortricid moth	X		Habitat data for Forest and Grassland unavailable
Regal fritillary butterfly			Currently not known to occur in the planning area
Albarufan dagger moth			Currently not known to occur in the planning area
Rocky Mountain capshell snail	X		Very rare in Colorado, very rare on Forest
PLANTS			
Western prairie fringed orchid			Currently not known to occur in Colorado
Ute ladies-tresses orchid			Currently not known to occur in the planning area
Osterhout mild-vetch			Currently not known to occur in the planning area
Colorado aletes	X		Limited to specialized habitat where effects from management activities are unlikely
Prairie moonwort	X		Plant associated with disturbance Only one occurrence documented in the planning area
Reflected moonwort	X		Plant associated with disturbance Restricted to specialized habitat
Pale moonwort	X		Plant associated with disturbance Restricted to specialized habitat
Clustered lady's-slipper	X		Difficult to monitor, other species selected as indicator to cover similar community characteristics
Hall's fescue	X		Restricted to one site within the planning area
Livid sedge	X		Restricted to one site within the planning area
Alpine feverfew		X	Restricted to specialized habitat
Front Range cinquefoil	X		Limited to specialized habitat where effects from management activities are unlikely
Northern blackberry	X		Limited occurrence, one known population on the Forest
Dwarf milkweed			Currently no known occurrence on the Forest or Grassland
Weber's scarlet-gilia			Currently no known occurrence on the Forest
Adder's mouth			Currently no known occurrence on the Forest
Weber's monkey-flower			Currently no known occurrence on the Forest

SPECIES	OCCURRENCE		REASON NOT SELECTED
	ARNF	PNG	
Autumn willow			Currently no known occurrence on the Forest
Sea pink	X		Specialized habitat and limited occurrence on the Forest
Slender moonwort			Currently no known occurrence on the Forest
Colorado butterfly weed			Currently no known occurrence on the planning area

III. Analysis of Effects of Forest Activities on MIS

A) Effects on Management Indicator Communities

Management indicator communities would be affected by proposed Forest and Grassland management as described in Chapter Three of the *FEIS.*

B) Effects on Management Indicator Species and Habitats

MAMMALS

Elk (Cervus elaphus)

1) Management Indicator Community Indicator for young to mature forest structural stages and openings within/adjacent to forests

2) Habitat Once they ranged east onto the Great Plains, but today they are associated with semiopen forests and forest edges adjacent to parks, meadows, and alpine tundra (Green 1982, Hoover and Wills 1987) Generalist feeders, elk are both grazers and browsers. In the northern and central Rocky Mountains, grasses and shrubs compose most of the winter diet, with the grasses becoming of primary importance in the spring months (Kufeld 1973). Forbs become increasingly important in late spring and summer, and grasses again dominate in the fall. Elk tend to inhabit higher elevations during the spring and summer and migrate to lower elevations for winter range Lengths of seasonal migration vary from about 6km to over 60km During winter, elk form large mixed herds on favored winter range (Fitzgerald 1994)

3) Habitat Effects Effects to elk are expected to generally vary by alternative according to the estimated amounts of grass-forb structural stages in the lodgepole pine type (Table 3 68) and habitat effectiveness (Tables 3 69 and 3 70) in the *Forest Plan* While elk are found throughout the Forests, the primary potential for habitat capability changes are in the vast lodgepole pine forests where the grass-forb stage is currently at 1 percent of the entire type It is here that a better balance of openings (more) to cover (less) would improve elk habitat Current low amounts of the grass-forb stage in other conifer types are less limiting to elk habitat because of non-forest openings that prevail within and nearby. Habitat effectiveness changes will also affect the useability of available lodgepole pine habitat for elk, as well as

all other ecosystems within the Forests.

4) Alternative Effects. Considering the combination of the lodgepole pine grass-forb stage and habitat effectiveness, elk habitat potential is considered to be highest and similar in Alternatives B, H and I, followed by A and C (same), and lastly E in decade 1 at both full and experienced budget levels.

5) Population Trends Elk populations are expected to remain generally high and potentially increase in all alternatives according to the above ranking. Populations that are viable, but also healthy and robust, are expected in all alternatives due to Forest habitat management. This is based on the above analysis, analyses of different habitat components important to elk (*FEIS* - Terrestrial Habitat and Wildlife) and direction in Chapters One, Two and Three (*Forest Plan*) that maintains and improves wildlife habitat

Mule deer (Odocoileus hemionus)

1) Management Indicator Community Indicator for young to mature forest structural stages, openings within/adjacent to forests, and prairie woodlands

2) Habitat. Occupy all ecosystems in colorado from grassland to alpine tundra Spring and summer ranges are most typically mosaics of meadows, aspen woodlands, alpine tundra-subalpine forest edges, or montane forest edges Seasonally the animals appear to be relatively sedentary, staying within areas of 40 to 900 ha In areas where deer do not migrate significant distances, annual home ranges are 7-22 square km (Mackie et al. 1982) In the Rocky Mountains, winter diets of mule deer consist mainly of browse from a variety of trees and shrubs with some forbs. In the spring, browse contributes half of the diet, and forbs and grasses make up the remainder. During the summer months, grass consumption declines in favor of forbs. Browse consumption increases and forb use declines throughout the fall and into winter (Carpenter et al 1979, Kufeld et al. 1973) Over much of Colorado the species is migratory, summering at higher elevations and moving downslope to winter range (Fitzgerald 1994)

3) Habitat Effects. Effects to mule deer are expected to generally vary by alternative according to the estimated amounts of grass-forb structural stages in the lodgepole pine type (Table 3.68) and habitat effectiveness (Tables 3 69 and 3 70) in the *Forest Plan* While mule deer are found throughout the Forests, the primary potential for habitat capability changes are in the vast lodgepole pine forests where the grass-forb stage is currently at 1 percent of the entire type It is here that a better balance of openings (more) to cover (less) would improve mule deer habitat Current low amounts of the grass-forb stage in other conifer types are less limiting to mule deer habitat because of non-forest openings of grasses, forbs and shrubs that prevail within and nearby. Habitat effectiveness changes will also affect the useability of available lodgepole pine habitat for mule deer, as well as all other ecosystems within the Forests.

Structural effects to mule deer habitat are not expected to vary by alternative because prairie

woodlands vegetation management will be similar in all alternatives. However, habitat effectiveness changes will affect the use of prairies woodlands as well as other Grassland ecosystems.

4) Alternative Effects Considering the combination of the lodgepole pine grass-forb stage and habitat effectiveness, mule deer habitat potential is considered to be highest and similar in Alternatives B, H and I, followed by A and C (same), and lastly E in decade 1 at both full and experienced budget levels on the Forests

Considering habitat effectiveness, mule deer habitat potential is considered to be highest in Alternative H, followed by B, and lastly the remaining alternatives (same as current) in decade 1 at both full and experienced budget levels on the Grassland

5) Population Trends. Mule deer populations are expected to potentially increase in all alternatives according to the above ranking on the Forests, and potentially increased or remain the same on the Grassland Populations that are viable and healthy are expected in all alternatives due to Forest and Grassland habitat management This is based on the above analysis, analyses of different habitat components important to mule deer (*FEIS* - Terrestrial Habitat and Wildlife - Mountains and Plains) and direction in Chapters One, Two and Three of the *Forest Plan* that maintains and improves wildlife habitat

Bighorn sheep (Ovis canadensis)

1) Management Indicator Community Indicator for openings within/adjacent to forest.

2) Habitat. Ranges from central British Columbia to Mexico, and from California east to western North Dakota and New Mexico. Inhabits mountain slopes with sparse growth of trees and rugged terrain. Most sheep have different winter and summer ranges, however, some stay in winter range year round. Prefers ledges, cliffs and steep slopes Winter range needs south-facing slopes swept clean from snow by wind. Also needed are steep rocks nearby for escape/safety purposes. Not territorial. Home range at any season includes the area between feeding and bedding which may be a mile in radius Mainly a grazer of grasses in the summer months, browse becomes the bulk of the diet during the winter months (USDA Forest Service 1981)

3) Habitat Effects Effects to bighorn sheep are expected to vary by alternative according to the estimated amounts of open corridors presented in Environmental Consequences - Open Corridors (*FEIS* - Chapter Three - Mountains - Terrestrial Habitat and Wildlife - Open Corridors). Forest treatments specifically designed to emphasize wildlife habitat needs and increase open corridors are primary determinants of this habitat for bighorn sheep.

4) Alternative Effects Increased and improved open corridors for bighorns are expected to be most in Alternatives B, A, H (in order, high to low) followed by Alternatives C and I (similar), and Alternative E least. This ranking by alternative is expected for all decades

5) Population Trends. Bighorn sheep populations are estimated to potentially increase and vary with the above ranking of alternatives, and remain viable in each alternative due to Forest habitat management This is based on analysis of this key habitat in the above discussion and *FEIS* referenced section, and direction in Chapters One, Two and Three (*Forest Plan*) that maintains and improves wildlife habitat

Townsend's big-eared bat (Plecotus townsendii)

1) Management Indicator Community. Indicator for cave and mine habitat.

2) Habitat. Occupies semidesert shrublands, pinon-juniper woodlands, and open montane forests Associated with caves and abandoned mines for day roosts and hibernacula, but will use crevices on cliffs for refuge Relatively sedentary, and do not move long distances from hibernacula to summer roosts, nor do they forage far from day roosts. These bats are late flyers, emerging well after dark. Caddisflies appear to be a staple of diet, which also includes moths, flies, and other insects They are gleaners, picking insects from leaves. Much foraging occurs over water, along margins of vegetation, and over sagebrush. Avoid mist nets and are difficult to detect unless roost sites are found (Fitzgerald, 1994)

3-4) Habitat Effects & Alternative Effects. Effects to Townsend's big-eared bat habitat are not expected to vary by alternative since caves and mines, whether remaining open or being closed, will be maintained or improved as bat habitat wherever bats occur in each alternative

5) Population Trends Accordingly, Townsend's big-eared bat populations potentials are not estimated to vary by alternative Populations are estimated to remain viable due to Forest and Grassland habitat management. This Is Based on this Analysis and Direction in Chapters One, Two and Three (*Forest Plan*) that assures maintenance and improvement of wildlife habitat - especially Forestwide standard 102 that specifically addresses bats, caves and mines

Black bear (Ursus americanus)

1) Management Indicator Community Indicator for interior forests.

2) Habitat. In North America, found throughout Canada, the Cascade, Sierra and Rocky Mountains and into Mexico in the west and the New England states, the Appalachians and southern Gulf states in the east. If they are territorial, it exists at important feeding sites The amount of home range needed is related to food types, availability and abundance For females, the average range is a ten mile radius Male black bears home range averages 15 miles, but may be as small as one square mile Black bears are omnivorous, with vegetation their mainstay They also eat fish during runs, hunter killed carrion and stream algae They are very opportunistic, and in all their food habits, they seek food high in protein or sugars (Burt and Grossenheider 1964, USDA Forest Service, 1981) Black bears need forest cover for concealment, escape and travel Although black bears may be conditioned to lose fear of humans, they are basically intolerant of humans Efforts to minimize human disturbance is important in favoring bear numbers (Hoover and Wills 1984).

3) Habitat Effects. Effects to black bear are expected to generally vary by alternative according to the estimated amounts of interior forests in the *Forest Plan* (Chapter Three - Mountains - Terrestrial Habitat and Wildlife - Environmental Consequences-interior Forests). Interior forests are contiguous areas of relatively dense and large trees that are buffered from human disturbance and the influence of adjacent openings.

4) Alternative Effects. Little change to interior forests is expected with any alternative Alternatives B and H are expected to maintain or slightly increase amounts of interior forest, and the remaining alternatives will cause small to moderate decreases

5) Population Trends Black bear populations are estimated to change little but potentially follow the above ranking of alternatives, and remain viable in each alternative due to Forest habitat management This is based on analysis of this key habitat in the above discussion and *FEIS* referenced section, and direction in Chapters One, Two and Three *(Forest Plan)* that maintains and improves wildlife habitat.

Black-tailed prairie dog (Cynomys ludovicianus)

1) Management Indicator Community. Indicator for prairie dog community

2) Habitat Common along plains and foothills from southern Canada and central North Dakota to south-central Texas, southeastern Arizona and northern Mexico Needs relatively large tracts of dry open grassland Territorial toward adjacent groups in its town. Populations living in "towns" are divided into wards which are divided into coteries. A coterie is about 5 acres of defended area by a family group. Consumes grasses and other vegetation and some insects. Highly colonial May be dormant in cold weather but not a true hibernator (Collins 1959, Burt and Grossenheider 1964, USDA Forest Service 1981) Many species of prairie wildlife are associated with prairie dog towns (Fitzgerald et al. 1994), making the prairie dog a keystone species which others are dependent on.

3-4) Habitat Effects & Alternative Effects. Effects to black-tailed prairie dog habitat are not expected to vary by alternative This is because prairie dog towns will be managed the same in all alternatives, and expected structural changes in vegetation by alternative are not expected to affect the occurrence of prairie dog towns.

5) Population Trends Accordingly, black-tailed prairie dog population potentials are estimated to not vary by alternative The plague continually affects prairie dog populations in the Pawnee National Grassland and transends estimated effects of Grassland habitat management. Populations are estimated to remain viable due to Grassland habitat management based on past experience, this analysis and direction in Chapters One, Two and Three (*Forest Plan*) that assures maintenance and improvement of wildlife habitat - especially Forestwide guideline 107 that specifically addresses prairie dog towns

BIRDS

Flamulated owl (Otus flammeolus)

1) Management Indicator Community Indicator for existing and potential old-growth forests

2) Habitat. A small insectivorous neotropical migrant of ponderosa pine and Douglas-fir forests They are secondary cavity nesters selecting cavities in the largest and oldest snags and live trees available Foraging of insects is often concentrated in 1-4 open patches of mature ponderosa pine on mid-slopes of ridge tops with southerly aspect. Daytime roosting occurs in dense thickets or large wolfy trees with sprawling form. Mistletoe may enhance the usefulness of roost trees (Hayward and Verner 1994) Owls have also been observed using dense secondary growth stands for calling and resting areas. Flamulated owls are territorial, and the most common species found during owl surveys (Hughes and Petterson 1994) This species is documented as breeding on the Arapaho and Roosevelt National Forests (Hayward and Verner 1994)

3) Habitat Effects. Effects to flammulated owl are expected to vary by alternative according to the estimated amounts of late successional ponderosa pine and Douglas-fir (habitat) presented in Table 3 67 (*FEIS* - Chapter Three - Mountains - Terrestrial Habitat and Wildlife - Vegetation Structure - Environmental Consequences) This table incorporates major agents of change that include tree growth, tree harvest, wildfire, prescribed fire and mechanical treatment of fuels

4) Alternative Effects. All alternatives change slightly the amount of habitat, with Alternatives A, C, E and I increasing 1 to 2 percent and Alternatives B, and H decreasing 1 percent from current amounts during decade 1. By decade 5 Alternatives E and I increase habitat the most (7 and 4 percent, respectively), Alternatives A and C are essentially the same as current amounts, and Alternatives B and H decrease habitat (6 and 5 percent, respectively) Accordingly, the capability of flammulated owl populations in decade 1 will remain essentially the same in all alternatives, and by decade 5 vary somewhat by alternative

5) Population Trends Flammulated owl populations, Forest Service sensitive species, are estimated to be maintained in decade 1 and potentially vary with the above ranking of alternatives by decade 5 Populations are expected to remain viable in each alternative due to Forest habitat management This is based on the above discussion and *FEIS* referenced section, the Biological Evaluation (*FEIS* - Appendix H), the Viability Assessment (*FEIS* - Chapter Three - Mountains - Terrestrial Habitat and Wildlife - Fine Scale Overview) and direction in Chapters One, Two and Three (*Forest Plan*) that maintains and improves wildlife habitat

Golden-crowned kinglet (Regulus satrapa)

1) Management Indicator Community Indicator for interior forest

2) Habitat. Utilizes conifers, Douglas fir, spruce-fir, lodgepole and aspen for feeding and nesting. Breeds primarily in dense coniferous forests, especially where spruce is present Winters in coniferous forests and occasionally in deciduous woodland scrub and brush (DeGraaf et al. 1991). Feeds upon insects and their eggs, also eats fruit and seeds Food is gleaned from foliage, small twigs, limbs and bark of trees and shrubs They may also hover to clean food from vegetation Fairly uncommon summer resident on the ARNF (USDA Forest Service 1995). This interior forest species tolerates little change on nesting grounds (USDA Forest Service 1981).

3) Habitat Effects. Effects to golden-crowned kinglet are expected to generally vary by alternative according to the estimated amounts of interior forests in the *Forest Plan* (Chapter Three - Terrestrial Habitat and Wildlife - Environmental Consequences- Interior Forests) Interior forests are contiguous areas of relatively dense and large trees that are buffered from human disturbance and the influence of adjacent openings

4) Alternative Effects Little change to interior forests is expected with any alternative Alternatives B and H are expected to maintain or slightly increase amounts of interior forest, and the remaining alternatives will cause small to moderate decreases.

5) Population Trends Golden-crowned kinglet populations are estimated to change little but potentially follow the above ranking of alternatives. Populations are expected to remain viable in each alternative due to Forest habitat management This is based on analysis of this key habitat in the above discussion and *FEIS* referenced section, and direction in Chapters One, Two and Three (*Forest Plan*) that maintains and improves wildlife habitat.

Three-toed woodpecker (Picoides tridactylus)

1) Management Indicator Community Indicator for existing and potential old-growth forest (snag component)

2) Habitat Distributed throughout the forested regions of Colorado Primary habitat is spruce-fir forests, but the species may also inhabit ponderosa pine, lodgepole pine and mixed conifer stands (Hoover and Wills 1984) This species may react favorably to insect infestations or wildfire (Andrews and Righter 1992) The basic habitat requirement for three-toed woodpeckers are mature and old growth forests with abundant snags for foraging and nesting Snags used for nest cavities are usually at least 12 inches in diameter and 15 feet in height. Home range size has been estimated to be approximately 100 acres of good quality old growth habitat (Hoover and Wills 1984).

3) Habitat Effects Effects to three-toed woodpecker are expected to vary by alternative according to the estimated amounts of late successional lodgpole pine and spruce-fir (habitat) presented in Table 3.67 (*FEIS* - Chapter Three - Mountains - Terrestrial Habitat and Wildlife - Vegetation Structure - Environmental Consequences) This table incorporates major agents of change that include tree growth, tree harvest, wildfire, prescribed fire and mechanical treatment of fuels.

4) Alternative Effects. All alternatives increase slightly-to-substantially the amount of habitat, with Alternative E having most, in both decades 1 and 5. Accordingly, the capability of three-toed woodpecker populations in decade 1 is highest in Alternative E (somewhat higher than current), followed by (slightly higher than current) B and H, and then A and I In decade 5, all alternatives have substantially higher capability for three-toed woodpecker populations than current and are highest with Alternative E followed in order by A, H, B, C and I

5) Population Trends. Three-toed woodpecker populations, Forest Service sensitive species, are estimated to potentially increase and vary with the above ranking of alternatives and remain viable in each alternative due to Forest habitat management This is based on the above discussion and *FEIS* referenced section, the Biological Evaluation (*FEIS* - Appendix H), the Viability Assessment (*FEIS* - Chapter Three - Mountains - Terrestrial Habitat and Wildlife - Fine Scale Overview), and direction in Chapters One, Two and Three (*Forest Plan*) that maintains and improves wildlife habitat

Hairy woodpecker (Picoides villosus)

1) Management Indicator Community Indicator for young to mature forest structural stages (snag component).

2) Habitat. Found in wooded areas throughout North America from the northern tree line to Panama. Mountain forests, mixed woodlands and river groves are all suitable habitat for hairy woodpeckers Six to nine acres per pair is required for successful breeding (USDA Forest Service 1981) Excavates cavities in snags or in live trees with decaying heartwood Consumes a diet that is about 80 percent animal food (wood-boring beetles removed from dead and diseased trees are an important source of food) Also eats other insects, fruits, corn, nuts, and cambium (DeGraaf et al. 1991)

3-4) Habitat Effects & Alternative Effects. Effects to hairy woodpecker habitat are not expected to vary by alternative since adequate snags, regardless of overall changes in forest structural stages, will be provided wherever forest management activities occur in each alternative

5) Population Trends Accordingly, hairy woodpecker populations potentials are not estimated to vary by alternative Populations are estimated to remain viable due to Forest habitat management. This is based on this analysis and direction in Chapters One, Two and Three (*Forest Plan*) that assures maintenance and improvement of wildlife habitat - especially Forestwide standard 58 that specifically addresses requirements for snags with timber harvest

Pygmy nuthatch (Sitta pygmaea)

1) Management Indicator Community Indicator for existing and potential old-growth forests

2) Habitat Most often associated with mature ponderosa pine stands, but Hoover and Wills (1984) also cited habitat use in subalpine forests, lodgepole pine and aspen. In all forested ecosystems, this species nests in natural or woodpecker created cavities when available It may also excavate its own cavities when other cavities are not present. Home range size is described by Hoover and Wills (1984) as being approximately 3 acres per breeding pair It altitudinally migrates during the winter months. They are very gregarious outside of the breeding season. Food is mainly insects which is gleaned from bark. Remainder of food is conifer seeds. During poor pine cone years it switches from pine to spruce fir seeds.

3) Habitat Effects. Effects to pygmy nuthatch are expected to vary by alternative according to the estimated amounts of late successional lodgpole pine and spruce-fir (habitat) presented in Table 3.67 (*FEIS* - Chapter Three - Mountains - Terrestrial Habitat and Wildlife - Vegetation Structure - Environmental Consequences) This table incorporates major agents of change that include tree growth, tree harvest, wildfire, prescribed fire and mechanical treatment of fuels.

4) Alternative Effects. All alternatives increase slightly-to-substantially the amount of habitat, with Alternative E having most, in both decades 1 and 5 Accordingly, the capability of pygmy nuthatch populations in decade 1 is highest in Alternative E (somewhat higher than current), followed by (slightly higher than current) B and H, and then A and I. In decade 5, all alternatives have substantially higher capability for pygmy nuthatch populations than current and are highest with Alternative E followed in order by A, H, B, C and I

5) Population Trends. Pygmy nuthatch populations, Forest Service sensitive species, are estimated to potentially increase and vary with the above ranking of alternatives and remain viable in each alternative due to Forest habitat management This is based on the above discussion and *FEIS* referenced section, the Biological Evaluation (*FEIS* - Appendix H), the Viability Assessment (*FEIS* - Chapter Three - Mountains - Terrestrial Habitat and Wildlife - Fine Scale Overview), and direction in Chapters One, Two and Three (*Forest Plan*) that maintains and improves wildlife habitat.

Warbling vireo (Vireo gilvus)

1) Management Indicator Community. Indicator for aspen communities

2) Habitat. In Colorado, common on the plains in migration and in the mountains in summer. Inhabits open deciduous and mixed deciduous-coniferous forests, especially streamside vegetation, but also in groves, scrubby hillside trees, and residential areas (DeGraaf et al 1991) These are the most common vireos of the state, nesting regularly in the Transition Zone. Usually nests in deciduous trees, especially cottonwoods along streams, in parks of the towns and cities adjacent to the foothills, and in aspen trees in the mountains to 10,000 feet (Baily and Niedrach 1965) Gleans much of its food from the mid- to upper-canopy of deciduous trees. Eats mostly animal matter but includes some small fruits (DeGraaf et al. 1991).

3) Habitat Effects. Effects to warbling vireo are expected to generally vary by alternative according to the estimated amounts of harvest and burning in conifers that removes overstory trees, creates openings and allows increased amounts of aspen restablishment. Most changes will occur in lodgepole pine forests. This is discussed in Environmental Consequences - Ground Cover Composition (*FEIS* - Chapter Three - Terrestrial Habitat-broad Scale Overview - Composition of Ground Cover). Forest treatments specifically designed to emphasize wildlife habitat needs and increase open corridors are also determinants of this habitat for warbling vireo

4) Alternative Effects Increased aspen for warbling vireo is expected to be most in Alternatives I, C, A, B, H and E (in order, high to low) in decade 1

5) Population Trends. Warbling vireo populations are estimated to potentially increase and vary with the above ranking of alternatives, and remain viable in each alternative due to Forest habitat management This is based on analysis of this key habitat in the above discussion and *FEIS* referenced section, and direction in Chapters One, Two and Three (*Forest Plan*) that assures maintenance and improvement of wildlife habitat - especially Forestwide guideline 39 that specifically addresses maintenance of aspen.

Wilson's warbler (Wilsonia pusilla)

1) Management Indicator Community. Indicator for montane riparian and wetlands

2) Habitat Breeds from northern Alaska, northern Yukon, Northern Ontario, southeastern Labrador, and Newfoundland south to southern California, central Nevada, northern Utah, northern New Mexico, central Ontario, northern New England, and Nova Scotia Winters from southern California and southern Texas to Panama Prefers wet clearings in early stages of regeneration Also inhabits peat or laurel bogs with scattered young or dwarf spruces and tamaracks, and riparian willow and alder thickets. Shrubby vegetation is a special habitat requirement Usually builds nest at base of small tree or shrub, often well concealed in a grass hummock Mostly eats insects gleaned from the ground and twigs or caught by flycatching Also eats spiders and fruit pulp (DeGraaf et al 1991)

3-4) Habitat Effects & Alternative Effects Effects to Wilson's warbler habitat are not expected to vary by alternative since riparian and wetland areas will be treated similarly in each alternative to provide adequate habitat

5) Population Trends Accordingly, Wilson's warbler populations potentials are not estimated to vary by alternative Populations are estimated to remain viable due to Forest habitat management. This is based on this analysis and direction in Chapters One, Two and Three (*Forest Plan*) that assures maintenance and improvement of wildlife habitat

Ferruginous hawk (Buteo regalis)

1) Management Indicator Community Indicator for shortgrass prairie and midgrass prairie

2) Habitat Found over the western half of North America where ever the combination of nesting sites is deciduous and coniferous trees, rock ledges and an abundant rodent supply are found. They are only summer residents in Canada. They are year round residents in Colorado They prefer habitats of deciduous trees, riparian zones at lower elevations in the foothills and on the plains. They are highly territorial and require approximately 10 square miles per nesting pair Ferruginous hawks prey primarily on lagomorphs (60-90%) and rodents with a few birds and reptiles taken (USDA Forest Service 1981).

3) Habitat Effects Effects to ferruginous hawk are expected to vary by alternative according to the estimated amounts of habitat effectiveness presented in Tables 3.76 and 3 77 (*FEIS* - Chapter Three - Plains - Terrestrial Habitat and Wildlife - Environmental -Habitat Effectiveness). Effects to ferruginous hawks are not expected to vary by alternative due to structural changes of shortgrass and midgrass.

4) Alternative Effects Habitat effectiveness is expected to increase in Alternatives B and H (2 and 7 percent, respectively), and remain at current levels for remaining alternatives in decade 1 at both full and experienced budget levels.

5) Population Trends. Ferruginous hawk populations, Forest Service sensitive species, are estimated to potentially increase in Alternatives B and H and remain the same in other alternatives Populations are expected to remain viable in each alternative due to Grassland habitat management This is based on analysis of this key habitat in the above discussion and *FEIS* referenced section, and direction in Chapters One, Two and Three (*Forest Plan*) that maintains and improves wildlife habitat

Mountain plover (Charadrius montanus)

1) Management Indicator Community Indicator for shortgrass prairie

2) Habitat Found on the high plains and arid regions of western valleys and hills, usually found far from water. Generally avoids mountainous areas and prefers areas dominated by blue grama and buffalo grass In winter, congregates in flocks of 15 to several hundred on alkali flats, plowed ground, razed pastures, or other open arid habitats. Consumes mostly, if not entirely insects caught on the dry plains and prairies, primarily grasshoppers, crickets, beetles and flies Fairly tolerant of disturbance except during nesting and brooding periods. Populations declining (USDA Forest Service 1991)

3-4) Habitat Effects & Alternative Effects Effects to mountain plover habitat are not expected to vary by alternative While shortgrass is key to nesting, plover are not now occupying all available habitat In other words, populations are presently limited by something other than nesting and brood rearing habitat on the Grassland.

5) Population Trends Accordingly the population of mountain plover, a Forest Service sensitive species, are not estimated to vary by alternative. Populations are estimated to remain viable due to Grassland habitat management. This is based on this analysis, the

Biological Evaluation (*FEIS* - Appendix H), the Viability Assessment (*FEIS* - Chapter Three - Plains - Terrestrial Habitat and Wildlife - Fine Scale Overview) and direction in Chapters One, Two and Three (*Forest Plan*) that assures maintenance and improvement of wildlife habitat

Mountain bluebird (Sialia currucoides)

1) Management Indicator Community. Indicator for openings within/adjacent to forests

2) Habitat Common from Alaska and British Columbia south throughout the west to southern California and Oklahoma (USDA Forest Service 1981) Nests in nearly all forest types of the Rocky Mountain region, usually from 7,000 to 11,000 feet in open forests or near forest edges During migration and in winter, also frequents grasslands, open brushy country, and agricultural lands. Usually nest in old woodpecker holes or natural cavities in dead trees in open areas near forest edges. Hawks from high perches or flies to the ground to catch its prey. Nearly 92 percent of the diet is animal material, the small amount of vegetable food includes fruits, hackberry seeds, and cedar berries (DeGraaf et al. 1991)

3) Habitat Effects. Effects to mountain bluebird are expected to generally vary by alternative according to the estimated amounts of grass-forb structural stages in the lodgepole pine type (Table 3 68) in the *Forest Plan*. While mountain bluebird are found throughout the Forests, the primary potential for habitat capability changes are in the vast lodgepole pine forests where the grass-forb stage is currently at 1 percent of the entire type. It is here that more openings would improve mountain bluebird habitat. Current low amounts of the grass-forb stage in other conifer types are less limiting to mountain bluebird habitat because of non-forest openings that prevail within and nearby.

4) Alternative Effects Considering amounts of the lodgepole pine grass-forb stage, mountain bluebird habitat potential is estimated to be highest in Alternative I, followed by A, B and C (same), then H, and lastly E in decade 1 In decade 5, potential habitat is highest in Alternative C, followed by B, H, I, then A, and lastly E This habitat increases in all alternatives except for Alternative E which remains at the current levels in decades 1 and 5

5) Population Trends Mountain bluebird populations are expected to potentially increase in all alternatives except Alternative E according to the above ranking Viable populations are expected in all alternatives due to Forest habitat management This is based on the above analysis, analyses of other habitats important to mountain bluebird (*FEIS* - Chapter Three - Terrestrial Habitat - Broad Scale Overview) and direction in Chapters One, Two and Three (*Forest Plan*) that maintains and improves wildlife habitat

Brown thrasher (Toxostoma rufum)

1) Management Indicator Community Indicator for prairie woodlands

2) Habitat Breeds from southern southern Canada to the Gulf Coast of Mexico and Florida,

and from the Atlantic coast to the Rocky Mountains (USDA Forest Service 1981) Rare visitor as far west as the Pacific Coast in migration and winter. During summer, inhabits dry thickets in wooded and farming country, brushy pastures, second-growth woods, fence rows, brier patches, roadsides, and sometimes shubbery of gardens Builds a bulky nest inshrubs or low trees, up to 14 feet from the ground, but sometimes on the ground under a small shrub. Gleans food from the ground or in shrubs. In spring, eats almost entirely insects, spiders and worms; in summer and fall, eats mostly fruits, mast (mainly acorns), and waste corn (DeGraaf et al. 1991).

3-4) Habitat Effects & Alternative Effects. Effects to brown thrasher habitat are not expected to vary by alternative because prairie woodlands will be managed similarly in all alternatives.

5) Population Trends Accordingly populations of brown thrasher are not estimated to vary by alternative. Populations are estimated to remain viable due to Grassland habitat management This is based on this analysis, and direction in Chapters One, Two and Three (*Forest Plan*) that assures maintenance and improvement of wildlife habitat.

Lark bunting (Calamospiza melanocorys)

1) Management Indicator Community Indicator for midgrass prairie.

2) Habitat. Common in the shortgrass prairie region of central North America In summer they are found from Kansas north and from Kansas south in winter (USDA Forest Service 1981) Inhabits mixed shortgrass prairie and other areas predominately low in growth, but also areas of taller grasses with scattered shrubs and disturbed grasslands Also inhabits sagebrush, fenced pastures, cultivated or fallow alfalfa or clover croplands, weedy roadsides, meadows, and areas of relatively barren ground. Nests in a depression on the ground, well concealed by prairie grasses and other vegetation, often near the base of a plant or plant debris Feeds on the ground, taking primarily insects during the summer, especially grasshoppers. In other seasons, eats seeds of weeds and grasses predominately.

3) Habitat Effects Effects to lark bunting are expected to vary by alternative according to the estimated amounts of medium and high structure midgrasses as discussed in the *FEIS* (Chapter Three - Plains - Terrestrial Habitat and Wildlife - Environmental Consequences - Vegetation Structure). This relatively high profile vegetation is currently limited to 5 percent of Grassland vegetation (Table 3 74 - *FEIS*)

4) Alternative Effects. Medium and high structure midgrasses are estimated to increase in Alternatives B and H (10-15 percent more than current over 50 years), and remain at current levels for remaining alternatives.

5) Population Trends Lark bunting populations are estimated to potentially increase in Alternatives B and H and remain the same in other alternatives Populations are expected to remain viable in each alternative due to Grassland habitat management. This is based on

analysis of this key habitat in the above discussion and *FEIS* referenced section, and direction in Chapters One, Two and Three (*Forest Plan*) that maintains and improves wildlife habitat.

Western burrowing owl (Athene cunicularia)

1) Management Indicator Community. Indicator for prairie dog community.

2) Habitat. Common throughout the west where vacant prairie dog holes are available in prairie regions. Also use rabbit or badger holes. In winter they migrate to southern U S and most of Mexico Owls are territorial requiring 1 acre to 1 8 acre per nesting pair. Main diet consists of grasshoppers, some beetles and moths Also takes small birds, mice and some crustaceans (USDA Forest Service 1981).

3-4) Habitat Effects & Alternative Effects Effects to burrowing owl habitat are not expected to vary by alternative. This is because prairie dog towns, which provide habitat for burrowing owls, will be managed the same in all alternatives Expected structural changes in vegetation by alternative are not expected to affect the occurrence of prairie dog towns or interactions of associated wildlife such as burrowing owls.

5) Population Trends Accordingly the population potentials of western burrowing owl, a Forest Service sensitive species, is estimated to not vary by alternative The plague continually affects prairie dog populations and towns, upon which the burrowing owl depends, and transends estimated effects of Grassland habitat management. Burrowing owl populations are estimated to remain viable due to Grassland habitat management based on past experience, this analysis, the Biological Evaluation (*FEIS* - Appendix H), the Viability Assessment (*FEIS* - Chapter Three - Plains - Terrestrial Habitat and Wildlife - Fine Scale Overview) and direction in Chapters One, Two and Three (*Forest Plan*) that assures maintenance and improvement of wildlife habitat - especially Forestwide guideline 107 that specifically addresses prairie dog towns

AMPHIBIANS

Boreal toad (Bufo boreas boreas)

1) Management Indicator Community Indicator for montane riparian and wetlands

2) Habitat Prefers mountain meadows and riparian deciduous vegetation at lower elevations Requires open water of some type for breeding Buries itself in loose soil or seeks shelter in burrows of gophers, ground squirrels, and other animals Waits for prey (moving insects) on surface of ground or in small burrows (USDA Forest Service 1981).

3-4) Habitat Effects & Alternative Effects Effects to boreal toad habitat are not expected to vary by alternative This is because montane riparian and wetland habitat for boreal toads will be managed the same in all alternatives. Estimated aquatic and terrestrial changes by

alternative (*FEIS* - Chapter Three) are not expected to affect boreal toad habitat.

5) Population Trends. Accordingly the population potentials of the boreal toad, a Forest Service sensitive species, is estimated to not vary by alternative. Populations are estimated to remain viable due to Forest habitat management based on this analysis, the Biological Evaluation (*FEIS* - Appendix H), the Viability Assessment (*FEIS* - Chapter Three - Plains - Terrestrial Habitat and Wildlife - Fine Scale Overview) and direction in Chapters One, Two and Three (*Forest Plan*) that assures maintenance and improvement of wildlife habitat

Northern leopard frog (Rana pipiens)

1) Management Indicator Community. Indicator for montane and prairie riparian and wetlands.

2) Habitat. Inhabits riparian areas, ponds, marshes, lakes and wet meadows. Wet areas with rooted aquatic vegetation are especially favored. Breeding takes place in shallow non-flowing bodies of water at elevations up to 10500 feet (Hammerson 1986)). During summer, adults prefer grassy areas, wet meadows and swampy areas surrounding pools and marshes Areas with 100% vegetative cover are preferred Frogs can cover long distances (3 miles) in dispersal and feeding forays Feeds mostly on arthropods: beetles, crickets, grasshoppers, aphids, ants, spiders, flies, caddisflies, etc Also eats worms, snails and slugs Tadpoles are herbivorous and scavengers Prime feeding grounds for larger frogs and insects in forested, drier parts of habitat (USDA Forest Service 1981)

3-4) Habitat Effects & Alternative Effects Effects to northern leopard frog habitat are not expected to vary by alternative. This is because riparian and wetland habitat for northern leopard frogs will be managed the same in all alternatives on Forests and Grassland Estimated aquatic and terrestrial changes by alternative (*FEIS* - Chapter Three) are not expected to affect northern leopard frog habitat

5) Population Trends Accordingly the population potentials of the northern leopard frog, a Forest Service sensitive species, is estimated to not vary by alternative. Populations are estimated to remain viable due to Forest habitat management based on this analysis, the Biological Evaluation (*FEIS* - Appendix H), the Viability Assessments (*FEIS* - Chapter Three - Mountains and Plains - Terrestrial Habitat and Wildlife - Fine Scale Overview) and direction in Chapters One, Two and Three (*Forest Plan*) that assures maintenance and improvement of wildlife habitat

MONTANE FISHES

Five trout species were selected as management indicators for the Arapaho and Roosevelt National Forests Native greenback cutthroat trout are federally listed as threatened. Native Colorado River cutthroat trout are listed as a species of special concern by the state, and are a Forest Service listed sensitive species Brown trout, brook trout, and rainbow trout are

introduced non-native fishes with recreational and economic significance. Because these five trout share common habitats and similar life histories, analysis for management indicator species has been simplified. Potential impacts of forest and rangeland management are analyzed in greatest detail for greenback cutthroat trout, for which viability is most tenuous across the planning unit Colorado River cutthroat trout are in a slightly more secure position, and analysis is less detailed for this subspecies. Brown trout, brook trout, and rainbow trout populations are more widespread and stable not only across the planning unit, but also across the United States Analyses of habitat impacts for brown, brook, and rainbow trout reference discussions for the two native trout, only unique risks (for example, impacts of whirling disease on rainbow trout populations) to each species are discussed in more detail.

Greenback Cutthroat Trout (Onchorynchus clarki stomias)

1) Management Indicator Community. Greenback cutthroat trout are an indicator of the health of montane aquatic ecosystems where they occur in isolated tributaries to the South Platte River drainage on the Arapaho and Roosevelt National Forests. Watersheds where greenback cutthroat trout occur are identified in the watershed condition assessment results shown in Table 3 11 of the *FEIS*. Specific recovery objectives and waters are identified in the greenback cutthroat trout recovery plan (USFWS 1995), in which the Forests are a participant

2) Habitat Greenback cutthroat trout originally ranged throughout the South Platte and Arkansas River drainages, but are currently restricted to several headwater streams and lakes within this range. Planning units on the Arapaho, Roosevelt, Pike, and San Isabel National Forests, two low elevation isolated private and military ponds, and Rocky Mountain National Park are the only places populations of this cutthroat trout subspecies occurs in the world.

Habitat requirements for greenback appear to be little different from other species of trout (USFWS 1995) Trout inhabit clear, cold, well-oxygenated streams with a gravel to rocky substrate Cutthroat trout are opportunistic feeders. Fingerlings feed mainly on insects, while older fish feed on insects and occasionally on smaller fish if available Trout require cover created by undercut banks, overhanging vegetation or eddies caused by instream boulders Greenback cutthroat trout do best in waters where other trout species are absent because of adverse effects from competition and the tendency toward hybridization Water temperatures less than 70 degrees Fahrenheit and high oxygen concentrations are required (USDA Forest Service 1981)

3) Habitat Effects Hybridization and competition from non-native species are the main threats to greenback cutthroat trout (USFWS 1995) Many historic greenback streams are now inhabited by non-natives which out-compete greenbacks or hybridize with greenback to the detriment of genetic purity Recovery efforts to date have focussed on reintroducing greenbacks to suitable habitat where non-native fishes could be removed and a fish barrier established to prevent competition and hybridization. Establishment of a broodstock is underway in a lake on the Roosevelt National Forest. Isolation from contact with other

species is also key to avoid exposure to exotic parasites (whirling disease) to which greenback are susceptible (USFWS 1995)

Degradation of stream and riparian habitat from management activities can also create suboptimal conditions for greenback cutthroat trout. Loss of habitat components and increased water temperature are two specific concerns

Opportunities exist to provide additional population security for greenback cutthroat trout. Some past reintroduction efforts have failed because artificial fish barriers installed to isolate greenback populations have not always been effective (USFWS 1995) Some barriers were poorly designed, and could be replaced with more effective barriers and recovery populations reestablished. Other barriers remain in place, but it is suspected that non-native fish have been introduced above them by forest visitors (Kehmeier, personal communication) Some reintroduction efforts failed because fish moved downstream out of high elevation streams where winter conditions were apparently unfavorable (Harig 1997)

Recent findings on metapopulation dynamics suggest that the current recovery plan objectives and criteria may not support long term viability of greenback cutthroat trout throughout their range, although isolated individual populations may persist on the planning unit. Young et al (1996) describe concerns with criteria for recovery populations of Colorado River cutthroat trout that can just as easily be applied to greenback, which also are isolated in tiny headwater areas. Greenback cutthroat trout historically may have moved throughout larger drainage areas in response to climate and habitat condition changes. For instance, greenback are thought to have used mainstem rivers such as the Cache la Poudre, but now are confined to tiny headwater steams This isolation may not allow for needed responses to severe weather conditions or to changes in habitat from natural events such as fire, nor does it allow for colonization of unoccupied habitats by mobile fish In combination, the inability to move between refugia may make it more likely that individual catastrophic events are more likely to affect viability of cutthroat subspecies across individual ranges (Young et al. 1996). Finally, some of the headwater recovery areas may be too small to support a sufficiently large population to allow for long term genetic persistence and viability (Young, personal communication).

Preliminary results from research ongoing at Colorado State University also indicate that larger basins characterized by more pools with complex habitat will be needed to maintain native cutthroat trout populations into the future, and that the highest quality isolated stream habitats must be selected for recovery efforts in the near future (Harig 1997) Additional sites for greenback reintroduction or recovery, particularly at a watershed scale, could be identified on the Forests This approach would represent a major shift from the current greenback recovery strategy, but may be necessary to ensure that "habitat must be well distributed so that [those] individuals can interact with others in the planning area" (NFMA Regulations 36 CFR 219 19).

There are also opportunities for individual, project level improvements in facilities that impact greenback habitat (for instance, country road culvert replacement) To be successful,

all of these activities would require cooperation between the Forest Service, the U.S. Fish and Wildlife Service, the Colorado Division of Wildlife, and other affected parties.

4) Alternative Effects. The greenback recovery plan (USFWS 1995) promotes sound land and water uses. The plan specifies that management activities should be reviewed to ensure that they are not negatively affecting greenback Overall effects of these activities on resource conditions have been described and compared for each alternative in the Environmental Impact Statement and Biological Assessment Impacts on greenback habitat are similar to impacts on habitat for all resident salmonid species Specific impacts to greenback cutthroat trout and their recovery habitats are best described at the site specific project level, but most potential effects are mitigated by application of Forest Plan standards and the Watershed Conservation Practices under any of the alternatives. In addition, consultation with U.S. Fish and Wildlife Service for projects that may affect greenback could result in application of additional mitigation measures as reasonable and prudent alternatives

Greenback cutthroat trout currently occupy approximately 26 miles of stream habitat and 11 acres of lake habitat on the Forests. Of these, populations in approximately 12 stream miles and 11 lake acres are considered stable The remaining populations are considered unstable because of the presence of non-native species, failure to reproduce, or failure to retain greenback in the habitat Streams where reintroduction has failed in the past may still be suitable for renewed recovery efforts if non-native species can be controlled. Additional potential habitat may be identified to replace habitat where reintroductions were unsuccessful Thus, while the location of greenback habitat may change during the planning period, overall habitat quantity will probably remain stable regardless of the alternative implemented

Quality of habitat is a function of natural conditions and whether habitat degradation occurs The greenback cutthroat trout recovery plan recognizes that the following activities have potential to affect greenback habitat grazing practices, maintaining riparian vegetation, silvicultural practices, mining activities, instream flow maintenance, water diversion and reservoir operation, and road construction (USFWS 1995)

Grazing and timber harvest are activities with potential to affect riparian vegetation and other components of greenback habitat Grazing is most likely to affect greenback habitat in meadow complexes where cattle congregate In these areas, stream channels are less armored, more susceptible to damage from trampling, and more dependent on presence of palatable willows or sedges for thermal cover and bank maintenance Meehan (1991) summarizes grazing effects on trout habitat as follows

> "The combination of upland erosion, loss of riparian canopies, and breakdown of streambanks [from grazing] lowers local water tables and causes streams to become wider but more shallow, warmer in summer but colder in winter, and poorer in instream structure but richer in nutrients and bacterial populations All these effects can adversely influence salmonid populations "

The number of active grazing allotments would be equal under each of the alternatives described in the *FEIS*, but animal unit months (AUMs) expected to be grazed would vary considerably. This analysis assumes that risk to aquatic ecosystems, including those where greenback cutthroat trout are present, is proportional to grazing pressure. AUMs grazed would vary from 8,200 (Alternative H) to 30,400 (Alternative I). Alternative B would close currently vacant allotments (some of which include greenback habitat) and graze 17,400 AUMs. Site specific analysis during allotment management planning would occur where greenback cutthroat trout were potentially impacted.

Impacts of grazing on greenback and their habitat were analyzed in detail in the "Biological Assessment for Greenback Cutthroat Trout in Aquatic Ecosystems Grazed by Domestic Livestock" (Greenback BA, USFS 1996). That assessment also identified mitigation measures that are intended to allow grazing to occur in watersheds occupied by greenback without likely adverse affects Those mitigation measures have been included in the Watershed Conservation Practices (WCP) Handbook, which is incorporated in the *Forest Plan* by reference Mitigation measures describe preferred grazing strategies and standards for herbaceous forage and woody plant utilization.

Timber harvest is most likely to directly impact greenback habitat in forested reaches, although indirect effect to downstream meadow reaches could be possible In forested reaches, stream channels tend to be more armored, so direct impacts to physical habitat features are less likely

The primary indirect effects of timber harvest on salmonid habitats are changed rates of sediment and nutrient delivery and changes in temperature and dissolved oxygen levels (Meehan 1991) Removal of canopy cover can change thermal regimes in forested streams Vegetation acts as an insulator that helps keep temperatures relatively warmer in the winter and colder in the summer. High summer temperatures can lead to chronic or acute stress and mortality. Low winter temperatures can reduce growth rates and survival of young of the year fish Removal of streamside trees can reduce potential for large woody debris to contribute to habitat complexity. Erosion from excessive ground disturbance could cause sedimentation to clog spawning gravels and overwinter habitat. Debris loading in streams can create excessive biochemical oxygen demand.

Analysis contained in the *FEIS* describes the risk to perennial fish-bearing streams from proposed levels of timber havest under each alternative. Relative to levels permitted by the existing plan (Alternative A), Alternative B would pose approximately half the risk (261 stream miles versus 490 stream miles in proximity to timber harvest). Alternatives E and H would further reduce risk of stream impacts (to 58 and 29 miles, respectively), while Alternative C would increase potential risk (534 stream miles). Alternative I would remain similar to risks under the current plan (414 stream miles) Of those stream miles potentially affected, only a minute portion is likely to occur in watersheds where greenback or Colorado River cutthroat trout or habitat are present. Impacts to widely distributed brook, brown, or rainbow trout are more likely simply because they are more common.

However, mitigation measures for activities that affect riparian areas, including timber harvest, are included in the WCP Handbook Both the WCP handbook and *Forest Plan* direction state that that activities in riparian areas should be carried out for the benefit of riparian dependent species, including greenback cutthroat trout.

Mining has potential to affect physical and chemical attributes of trout habitat (Meehan 1991), and may affect greenback if recovery streams are adjacent to mined lands Greenback recovery streams do occur in proximity to the mineralized portions of the Forests.

Nelson et al. (1991) describe the wide array of impacts to salmonids and their habitats that can be attributed to mining activities. Instream dredge mining can create temporary or permanent reductions in fish habitat structure, because small particles are sorted out from larger particles and generally not replaced. Suspended sediment plumes are associated with dredge mining, and can cause both respiratory distress and downstream sedimentation. Hardrock mining also can affect trout habitats Acid mine drainage and high metal concentrations can create conditions where cutthroat cannot survive or reproduce (USFWS 1995).

Mining activities occur as a function of mineral values and proposals from outside interests, rather than as a function of Forest Service program levels. All alternatives analyzed for the *Forest Plan FEIS* identify equal levels of expected mineral exploration and recovery

Mining activities are carried out under the 1872 Mining Law, which has considerable authority Forest Service ability to influence mining activities is sometimes limited Where possible, mitigation measures are applied to avoid or reduce impacts to aquatic ecosystems.

Road construction is often associated with mining or timber harvest, but also occurs as a result of recreation management, access to private inholdings, and to allow other special uses The connected disturbed areas associated with roads have been identified as the source of increased water yield, and increased sediment production and delivery This can lead to channel instability and reduction in trout habitat components (Meehan 1991). Roads can also lead to reduced fish access to habitats, since culverts are common barriers to fish movement Finally, new roads into previously isolated habitat can put vulnerable populations of greenback at risk of increased fishing pressure and harvest

The most important steps to reduce adverse effects of roads on streams take place during planning, reconnaissance, and route selection at the project level rather than during or after construction (Furniss, et al 1991). Mitigation measures identified in the WCP Handbook are applied during road planning

Once roads are constructed, there is little that can be done to reduce impacts to salmonid habitats, although specific problems (such as poor culvert placement or obliteration of redundant roads) can sometimes be addressed. Tables 3 69 and 3 70 of the *FEIS* describe changes in roads and trails open to public use across the Forests under each alternative for two budget scenarios Experienced budget levels are used here for comparison Travelway

density would remain very similar (varying from 1.3 to 1 6 miles per square mile) for all alternatives Under Alternative H there would be the greatest emphasis on reducing existing road densities through closure and obliteration. Alternative B represents the second greatest movement to obliterate existing ways, which tend to have direct impacts on streams, including greenback habitat. Under no alternative would the travelway density go up across the Forests as a whole, although local reductions could be balanced by new construction in other areas. Areas where travelways conflict with threatened or endangered species management should be high in priority for obliteration.

Instream flow maintenance is closely linked to the effects of water diversion and reservoir operation. Water facilities are operated on the Forests under special use permits. Effects of flow depletions and augmentation can be significant, and are described best in the Aquatic and Riparian Resources Environmental Consequences section of the *FEIS*. Most greenback recovery populations and habitats are located in headwater areas upstream of water facilities, so there is limited need for protection of instream flows However, individual streams with greenback populations or potential habitat are affected by existing water facilities on the Forests. Mitigation measures including minimum instream flows are considered during issuance of permits for individual facilities, but cannot be imposed under current direction. In some cases, voluntary minimum instream flow agreements can be formalized through the Colorado Water Conservation Board, but this issue is highly contentious on the Forests

Water facilities themselves (dams, diversions, and ditches) have created changes in barriers to movement patterns that greenback probably once used As stated above, greenback likely once used a range of habitats from headwaters to mainstem streams, depending on season, water levels, and habitat conditions. Even if conflicts with non-native fish introductions could be reduced, greenback could not move up and downstream past dams and diversion facilities without considerable investment in fish passage structures

Conversely, trans-basin diversions now connect watersheds that have been geologically isolated for thousands of years Diversion of water from the Colorado River headwaters into the headwaters of the Cache la Poudre River via the Grand Ditch, for instance, may have resulted in movement of Colorado River cutthroat into historic greenback habitat, or vice versa. Likewise, presence of greenback cutthroat trout hybrids in headwater areas of the Laramie River basin (where no native trout lived and stocking is not documented) may indicate fish movement through the Bob Creek ditch from tributaries to the Poudre This movement may have confused the purity of native cutthroat strains, and now may create vectors for further non-native fish movement and disease distribution. Thus, changes in movement patterns created by water facilities may also represent a long term conflict with viable patterns of population distribution.

Despite the potential for significant adverse effects of water facilities and their operation on aquatic habitats, some of which are used by greenback, effects are not expected to vary by alternative Demand for water-use authorizations is driven by proponents of water development rather than by Forest programs or budget, and many facilities are operated under potential easements or other authorizations that are not subject to environmental mitigation.

Prescribed fire has been reintroduced to simulate natural conditions on the Forests Greenback cutthroat trout would have evolved in an ecosystem driven by natural fires. However, greenback would have had more ability to move in response to habitat changes resulting from fire. Where recovery populations are now isolated with few refugia, prescribed fire must be carefully applied to allow protection of greenback cutthroat trout and their habitat These projects represent an opportunity to monitor changes in montane riparian condition and fisheries habitat through fire

Insect and disease management on the Forests is focussed on reduction in endemic mistletoe, mountain pine beetle, and fungal diseases Salvage logging can sometimes be used to reduce these elements Reintroduction of prescribed fire in the ecosystem can also be used to reduce fuels and eliminate stand structures that perpetuate spread of insects or disease. Refer to discussions of timber harvest and prescribed fire management above. Use of pesticides or herbicides for pest management on the Forests is extremely limited, and occurs in compliance with manufacturer's labelling, so risks of adverse effects on aquatic ecosystems are minimized in all cases Structural stages on the Forests would generally be maintained overall, but the distribution of age classes would shift from middle age classes dominating to increases in younger and older age classes and structural stages

There is potential for access or dispersal conflicts related to visitor uses in watersheds with greenback cutthroat trout populations Several catch and release fishing opportunities have been established with greenback to create awareness and appreciation of potential for native fisheries However, unlawful harvest is a concern where public access to greenback streams is frequent (USFWS 1995) Good public access is generally a deterrent to selection of stream reaches for recovery efforts to avoid this concern

5) Management Indicator Community. A determination of "may affect, not likely to adversely affect" for greenback cutthroat trout is documented in the biological assessment for Alternative B (Appendix I) Greenback cutthroat trout habitats are expected to remain approximately stable at the current levels, and habitat protection through mitigation should be successful, regardless of what alternative is selected for implementation Current habitat levels are sufficient to provide viability over the planning period for the existing stable populations of greenback cutthroat trout on the Arapaho and Roosevelt National Forests Unstable greenback populations are likely to continue to decline because of competitive or genetic pressure from non-native fishes Continued viability across the planning unit beyond this planning period may rely on an expanded greenback management effort that includes designation of larger recovery watersheds to allow development of metapopulations Exotic disease, continued expansion of non-native salmonid populations, and physical barriers to historic greenback movement patterns are threats to viability that are beyond jurisdiction of the Forests

Colorado River Cutthroat Trout (Onchorynchus clarki pleuriticus)

1) Management Indicator Community Colorado River cutthroat trout are an indicator of the health of montane aquatic ecosystems where they occur in isolated tributaries of the Colorado

River drainage Watersheds where Colorado River cutthroat trout occur are identified in the watershed condition assessment results shown in Table 3.11 of the *FEIS* Two phases of restoration activities (conservation and reintroduction) are detailed in the "Conservation Plan for Colorado River Cutthroat Trout in Northwest Colorado," a cooperative work plan in which the Araphao and Roosevelt National Forests are partners with other Forest Service planning units, the Bureau of Land Management, and the Colorado Division of Wildlife (USFS et al. 1992).

2) Habitat. Colorado River cutthroat trout originally ranged throughout the Colorado River drainages in Colorado, Wyoming, Utah, New Mexico and Arizona While the subspecies is likely to have used portions of larger mainstem rivers, it is now restricted to less than 1 percent of its historic range, including several headwater streams on the Arapaho National Forest (Young 1995a). Colorado River cutthroat trout also occur in planning units associated with the Medicine Bow, Routt, White River, San Juan, Rio Grande, and Bridger-Teton National Forests, as well as a number of Bureau of Land Management units.

The ecological requirements of Colorado River cutthroat trout are relatively generalized, which allows this subspecies to survive in a wide range of habitats. The Colorado River cutthroat trout is even considered to be "hardier" than other interior cutthroat subspecies (USFS et al. 1992). On the Forest, these trout inhabit relatively cool, clear streams with well vegetated streambanks for cover and bank stability Instream cover in the form of rocks, pools, and downed trees is also important. Clean gravels are necessary for spawning and egg laying Lower gradient areas are required for rearing of juveniles (USDA Forest Service 1981). Like most other cutthroat subspecies, Colorado River cutthroat evolved in isolation from other trout species, and the most critical habitat attribute required for pure, self-sustaining populations is the absence of other trout species (USFS et al 1992).

3) Habitat Effects. Thus, hybridization, competition from non-native species, and exotic disease (whirling disease) introductions are also the main threats to Colorado River cutthroat trout. Many historic cutthroat streams are now inhabited by non-natives which out-compete native cutthroat Hybridization with non-native species has compromised genetic purity of this species in many streams (Young et al. 1996) Alteration to stream habitats and adjacent riparian areas from management activities, and water diversions from cutthroat habitat, have also negatively impacted populations (USFS et al. 1992) Degradation of stream and riparian habitat, specifically loss of habitat components and increased water temperature, can create suboptimal conditions for Colorado River cutthroat trout

Opportunities exist to provide additional population security for Colorado River cutthroat trout A recently completed environmental assessment outlines a programmatic strategy for Colorado River cutthroat trout projects on the Routt National Forest (USFS 1997). The objectives outlined are to·

> ". construct trout migration barriers to protect Colorado River cutthroat trout populations from the upstream movements of non-native trout while providing adequate habitat and population size to ensure continued viability ...

". implement instream habitat improvements to improve the capability of the waters to support Colorado River cutthroat trout populations where degraded or sub-optimal habitat exists .

" eliminate the source of impacts, and restore or enhance riparian and watershed conditions, where the impacts are determined to limit habitat capability .

" communicate with forest users, private landowners, and other agencies and groups about the status of Colorado River cutthroat trout and the conservation actions that are being implemented to protect the subspecies "

A similar project by project approach has been taken on the Arapaho National Forest, and should be continued in the future There are populations at risk of hybridization or competition from non-native fish that could be temporarily isolated by creation of artificial barriers, however, this is a short-term solution. Additional sites for reintroduction or recovery could be identified As with greenback cutthroat trout, however, a watershed scale, multi-agency cooperative approach to Colorado River cutthroat trout conservation may be needed to ensure longer term population viability

4) Alternative Effects. Effects on Colorado River cutthroat trout and their habitats proposed under the alternatives described in the *FEIS* would be very similar to those described for greenback cutthroat trout Overall effects of activities on resource conditions have been described and compared for each alternative in the Environmental Impact Statement and Biological Evaluation. Specific impacts to Colorado River cutthroat trout and their conservation habitats are best described at the site specific project level, but most potential effects are mitigated by application of Forest Plan standards and the Watershed Conservation Practices under any of the alternatives Genetically pure Colorado River cutthroat trout currently occupy approximately 12 miles of habitat in six streams on the Sulphur Ranger District of the Arapaho National Forest Known hybrids are present in another ten streams (some tributaries of the other), and populations of untested purity are present in another five streams and two lakes (Young et al 1996) Reasonably foreseeable management impacts are known to potentially affect one stream occupied by a pure population. In many cases, pure populations are not presently isolated by effective fish barriers, so that even in the short term there is risk of further loss of purity (Young et al. 1996) There are no streams presently identified for reintroduction of additional Colorado River cutthroat populations. Thus, the amount of habitat available for Colorado River cutthroat trout conservation will probably remain stable or decrease slightly under any of the alternatives

Trends in habitat quality would be very similar to those described for greenback cutthroat trout Timber harvest, road construction, water development, and livestock grazing represent the most widespread activities with potential to affect Colorado River cutthroat trout habitat quality Young et al. (1996) identified grazing as the land management activity that most frequently had impacts on Colorado River cutthroat trout in the state of Colorado. To assess impacts of grazing specifically, Colorado River cutthroat trout were included in the "Biological Evaluation for Sensitive Species in Riparian Areas Grazed by Domestic Livestock" (USFS 1995a), which describes habitat needs, grazing effects, and mitigation measures to protect riparian dependent species The mitigation measures have been

incorporated in the the WCP Handbook and are incorporated as Forest Plan standards by reference. Species specific impacts of insect and disease management, prescribed fire, and human access are expected to mirror those described for greenback cutthroat trout. Reference discussions of effects on greenback habitat for pathways of indirect impacts from these activities.

5) Population Trends. A determination of "may adversely impact individuals, but not likely to result in a loss of viability" for Colorado River cutthroat trout is documented in the biological evaluation for Alternative B (Appendix H). Regardless of what Forest Plan alternative is selected for implementation, Colorado River cutthroat trout habitats are expected to remain approximately stable at the current levels if habitat protection through mitigation is successful at the project level. Current habitat levels are sufficient to provide viability over the planning period for the existing stable populations of Colorado river cutthroat trout on the Arapaho National Forest. If mitigation of project effects is not possible, slight decreases in cutthroat habitat may result, and currently stable individual populations may become unstable Where Colorado River cutthroat populations are currently unstable because of encroachment by non-native species, populations are likely to continue to decline because of competitive or genetic pressure from non-native fishes Continued viability across the planning unit beyond this planning period may rely on an expanded conservation effort that includes designation of larger recovery watersheds to allow development of metapopulations. Exotic disease, continued expansion of non-native salmonid populations, and physical barriers to historic Colorado River cutthroat trout movement patterns are threats to viability that are beyond jurisdiction of the Forests

Brook Trout (Salvelinus fontinalis)

1) Management Indicator Community Brook trout are not native to the Arapaho and Roosevelt National Forests, but are now a widespread desired species, and are a management indicator of the health of montane aquatic ecosystems where they occur. General distribution is indicated in Table 3 14 of the *FEIS*

2) Habitat Brook trout are native to the eastern United States, but adapt well to conditions in the Rocky Mountain west (Beckman 1963, Meehan and Bjornn 1991) These fall spawning fish use habitat in the headwater reaches of small streams, and are equally at home in flowing streams and beaver pond complexes Fine clean gravels are used for spawning, and deep pools are needed for overwintering at high elevations These fish reproduce successfully under many conditions, and are managed as "wild" populations by the Colorado Division of Wildlife in most cases, so serve as a good reference for unaugmented population trends.

3) Habitat Effects Habitat alteration from Forest management activities and water diversions can negatively impact populations Degradation of stream and riparian habitat, specifically loss of habitat components through water diversions and increased water temperature, can create suboptimal conditions for brook trout. Because they are so widespread, it is most likely that brook trout are directly affected by water development activities.

There are no specific opportunities to enhance habitat or population conditions for brook trout on the Forests. General watershed improvement activities, including designation of minimum instream flows, that reduce overall impacts to aquatic habitats are beneficial on a site specific basis.

4) Alternative Effects Impacts on brook trout habitat are similar to impacts on habitat for all resident salmonid species. Overall effects of these activities on resource conditions have been described and compared for each alternative in the Environmental Impact Statement. Specific impacts to brook trout and their habitats are best described at the site specific project level, but most potential effects are mitigated by application of Forest Plan standards and the Watershed Conservation Practices under any of the alternatives

Brook trout are widespread and common on the Forests. Brook trout are expected to occur in virtually all of the 1,937 miles of perennial stream on the Forests, save those occupied exclusively by native cutthroat subspecies Brook trout are also common in high elevation lakes and reservoirs In this area, quantity of brook trout habitat is partly determined by the amount of stream dewatering or reservoir drawdown that occurs. Where streams and lakes are dewatered by operation of water facilities during all or part of the year, habitat for brook trout is absent. However, there are no known new water facilities proposed, so there would be no new stream reaches dewatered. Fluctuation in water level in existing reservoirs would continue to create variable lentic habitat from season to season and year to year. Overall the amount of brook trout habitat will probably remain stable under any of the alternatives

Quality of habitat is a function of natural conditions and whether habitat degradation occurs Impacts of management activities on the Forests described for greenback and Colorado River cutthroat trout would also affect the quality of brook trout habitat The only difference is that brook trout are fall spawners, so the timing of activities might lead to different degrees of effect than for spring spawning cutthroat trout, and brook trout are far more widespread, so could be affected by more activities

5) Population Trends Risks to viability of brook trout populations across the planning unit are negligible Habitat levels are expected to remain stable through time Habitat effects from management activities are mitigated by application of watershed conservation practices under any of the Forest Plan alternatives Individuals and populations in specific streams affected by water diversions may periodically experience mortality, but connectivity of brook trout populations across large portions of the Forests provide opportunity for movement and recolonization in response to changed habitat conditions We assume that because there are no other significant threats to viability known, stable habitats should correlate with stable population trends. Viability of brook trout on the Arapaho and Roosevelt National Forests should be retained.

Brown Trout (Salmo trutta)

1) Management Indicator Community. Brown trout are not native to the Arapaho and Roosevelt National Forests, but are now widespread and are desired as a sport fish Brown

trout are a management indicator of the health of montane aquatic ecosystems where they occur General distribution is indicated in Table 3.14 of the *FEIS*.

2) Habitat Brown trout are native to western Europe, but have adapted well to conditions in the Rocky Mountain west (Beckman 1963). These fish use habitat in small streams for spawning in the fall, but often spend the remainder of the year in larger streams. Brown trout are considered to be the most tolerant of high temperatures and turbid stream conditions (Beckman 1963). These fish have been shown to be highly mobile (Gowan et al. 1994), moving as much as 50 miles over the course of the summer. Medium sized clean gravels are used for spawning in the fall, and deep pools are needed for overwintering. In a recent study of brown trout habitat use, habitat and cover associated with beaver activity and large woody debris were used preferentially over other habitat types (Young 1995b) Brown trout are both insectivorous or piscivorous, depending on size and the prey base available. These fish also reproduce successfully under many conditions, and are managed as "wild" populations by the Colorado Division of Wildlife in most cases, so serve as a good reference for unaugmented population trends

3) Habitat Effects. Habitat alteration from Forest management activities and water diversions can negatively impact populations. Degradation of stream and riparian habitat, specifically loss of habitat components through water diversions, can create suboptimal conditions for brown trout Because they are widespread, it is likely that brown trout are directly or indirectly affected by most water development activities. In addition, brown trout have recently been shown to be susceptible to whirling disease, although the impacts of this disease on brown trout populations are not known

There are no specific opportunities to enhance habitat or population conditions for brown trout on the Forests General watershed improvement activities, including designation of minimum instream flows, that reduce overall impacts to aquatic habitats are beneficial on a site specific basis

4) Alternative Effects Impacts on brown trout habitat are similar to impacts on habitat for all resident salmonid species Overall effects of these activities on resource conditions have been described and compared for each alternative in the Environmental Impact Statement Specific impacts to brown trout and their habitats are best described at the site specific project level, but most potential effects are mitigated by application of Forest Plan standards and the Watershed Conservation Practices under any of the alternatives.

Brown trout are relatively widespread and common on the Forests Brown trout are documented in or expected to occur in virtually all of the lower elevation mainstem perennial stream on the Forests, but also have been documented in small streams at nearly 10,000 feet above sea level In this area, quantity of brown trout habitat is partly determined by the amount of stream dewatering that occurs Where streams are dewatered by water facilities during all or part of the year, habitat for brown trout is reduced or absent However, there are no known new water facilities proposed, so there would be no new stream reaches dewatered Overall the amount of brown trout habitat will probably remain stable.

Quality of habitat is a function of natural conditions and whether habitat degradation occurs Impacts of management activities on the Forests described for greenback and Colorado River cutthroat trout would also affect the quality of brown trout habitat The only differences are that brown trout tend to occur at lower elevations where cumulative effects are aggregated, and that brown trout are fall spawners, so the timing of activities might lead to different degrees of effect than for spring spawning cutthroat trout.

5) Population Trends Risks to viability of brown trout populations across the planning unit are negligible. Habitat levels are expected to remain stable through time. Habitat effects from management activities are mitigated by application of watershed conservation practices under any of the Forest Plan alternatives Individuals and populations in specific streams affected by water diversions may periodically experience mortality, but connectivity of brown trout populations across relatively large portions of the Forests provide opportunity for movement and recolonization in response to changed habitat conditions We assume that because there are limited threats to viability known, stable habitats should correlate with stable population trends Viability of brown trout on the Arapaho and Roosevelt National Forests should be retained, with the recognition that the spread of exotic disease (whirling disease) is a potential threat to viability beyond control of the Forests

Rainbow Trout (Onchorynchus mykiss)

1) Management Indicator Community. Rainbow trout are not native to the Arapaho and Roosevelt National Forests, but are now widespread, and are a management indicator of the health of montane aquatic ecosystems where they occur in naturally reproducing populations General distribution is indicated in Table 3 14 of the *FEIS*.

2) Habitat. Rainbow trout are native to the coastal western United States, but have adapted to inland conditions in the Rocky Mountain west (Beckman 1963). These spring/early summer spawning fish use habitat in the lower reaches of small streams and in mainstem rivers, and are also common in lakes and reservoirs Clean gravels are used for spawning, and deep pools are needed for overwintering Rainbow trout have been shown to be relatively mobile (Young et al 1997) where barriers to movement such as diversion dams or dewatered stream reaches are not present These fish can reproduce successfully under conditions found on the Forests, but are more often managed as hatchery supplemented populations Where rainbow trout are are managed as "wild" populations by the Colorado Division of Wildlife, they can serve as a good reference for unaugmented population status Where populations are augmented by hatchery stock or where whirling disease has impacted populations, management indicator utility is limited

3) Habitat Effects Habitat alteration from Forest management activities and water diversions can negatively impact populations Degradation of stream and riparian habitat, specifically loss of habitat components and increased water temperature, can create suboptimal conditions for rainbow trout. However, the most serious threat to rainbow trout population viability is whirling disease, which has decimated natural reproduction in many of the mainstem rivers statewide, including on the Forests (Nehring 1996). Rainbow trout also appear to be

susceptible to disturbance by humans, and can be displaced by more than 300 feet from habitat used prior to disturbance (Young et al 1997).

There are no specific opportunities to enhance habitat conditions for rainbow trout on the Forests General watershed improvement activities, including designation of minimum instream flows, that reduce overall impacts to aquatic habitats are beneficial on a site specific basis Throughout the range of rainbow trout on the forest, there may be opportunities to cooperate with the Colorado Division of Wildlife to limit spread of whirling disease organisms, or to restore fisheries if a treatment for the disease can be determined. Until such time, however, all rainbow trout populations across the Forests remain at risk of reduced reproduction and/or whirling disease introduction.

4) Alternative Effects Impacts on rainbow trout habitat are similar to impacts on habitat for all resident salmonid species. Overall effects of these activities on resource conditions have been described and compared for each alternative in the Environmental Impact Statement Specific impacts to rainbow trout and their habitats are best described at the site specific project level, but most potential effects are mitigated by application of Forest Plan standards and the Watershed Conservation Practices under any of the alternatives

Rainbow trout are widespread and common on the Forests. Rainbow trout are documented in or expected to occur in virtually all of the moderate to lower elevation mainstem perennial stream on the Forests. Quantity of rainbow trout habitat is partly determined by the amount of stream dewatering that occurs Where streams are dewatered by water facilities during all or part of the year, habitat for rainbow trout is reduced or absent. However, there are no known new water facilities proposed, so there would be no new stream reaches dewatered. Overall the amount of physical rainbow trout habitat will probably remain stable.

Quality of habitat is a function of natural conditions and effects from management activities. Impacts of management activities on the Forests described for greenback and Colorado River cutthroat trout would also affect the quality of rainbow trout habitat. Rainbow trout, like brown trout, tend to occur at lower elevations where cumulative effects are aggregated Since rainbow trout are also spring spawners, so the timing of activities would lead to similar effects as for spring spawning cutthroat trout.

The most significant impact on habitat quality for rainbow trout is whether the habitat has been infected with whirling disease Where rainbow trout habitat has been infected by whirling disease, there is potential for put-and-take (stocked) fisheries exists, but not for wild, naturally reproducing populations The amount of physical rainbow trout habitat is expected to remain stable, but biological pressure (whirling disease) is likely to continue to reduce habitat quality for wild rainbow trout populations.

5) Population Trends Risks to viability of rainbow trout populations across the planning unit are substantial, but not directly related to effects of National Forest management on habitats Physical habitat levels are expected to remain stable through time. Habitat effects from management activities are mitigated by application of watershed conservation practices under

any of the Forest Plan alternatives. Individuals and populations in specific streams affected by water diversions may periodically experience mortality, but connectivity of rainbow trout populations across relatively large portions of the Forests provide opportunity for movement and recolonization in response to changed habitat conditions. However, because rainbow trout populations are relatively well connected, there is a substantial risk of the spread of whirling disease organisms into currently disease-free habitat. Inadvertent spread of disease organisms through recreational use, wildlife or waterfowl movement, or fisheries management activities (stocking, sampling, etc) may occur We assume that where whirling disease is absent, stable habitats should correlate with stable population trends. However, if monitoring indicates declines in rainbow trout indicator populations, impacts from disease must be considered in addition to impacts of land management activities From a habitat maintenance standpoint, viability of rainbow trout on the Arapaho and Roosevelt National Forests should be retained, with the recognition that the spread of exotic disease (whirling disease) is a threat to viability beyond the jurisdiction of the Forests.

PLAINS FISHES

Two native minnow species were selected as management indicators for the Pawnee National Grassland. The plains topminnow is identified as a sensitive species by the Forest Service. The plains killifish is a native fish with no special management status Some plains topminnow habitats are shared with plains killifish, and vice versa, and effects on the two species are similar Where the species do not overlap, they each represent an indicator of aquatic ecosystem health.

Plains Topminnow

1) Management Indicator Community Plains topminnows are a management indicator of the health of prairie aquatic ecosystems where they occur in streams and perennial potholes on the Pawnee National Grassland Based on recent CDW and Forest Service surveys, Coal Creek, Willow Creek, and tributaries of Pawnee Creek are known to contain topminnow populations

2) Habitat Plains topminnows inhabit perennial sterams and isolated perennial potholes on the Grassland Changes in fish distribution are limited to rare high flow events (CDW 1997) Clear sand or gravel-bottomed streams with abundant vegetation are preferred Eggs are deposited randomly over a gravel substrate This fish requires abundant filamentous algal growth and still, clear water Insects are sometimes eaten (USDA Forest Service 1981)

3) Habitat Effects Exotic fish species as well as habitat degradation can reduce populations Primary risks are related to the scarcity of perennial surface water on the Grassland Available water is used and reused by many grazing and agricultural interests, which can lead to flow depletions and degraded water quality (CDW 1997) Effluent from feedlots and farmlands can hurt populations (CDW 1985) Sedimentation can have a severe effect on populations by covering spawning gravels and increasing turbidity Introduction of Gambusia spp. (mosquito fish) has been identified as a primary cause of the decline in

populations of topminnows (Mark Ball, personal communication) Plains topminnows were found to be common in Willow Creek and Pawnee Creek (CDW 1997) The success of newly reintroduced populations in Coal Creek have not yet been evaluated.

CDW identified restoration of historic streamflow as a potential opportunity to enhance conditions for native prairie fishes, including plains topminnow, but recognized that this is probably not feasible. Potential for fencing areas of riparian habitat was also identified as a means to provide recovery of a saturated water table that could provide more habitat through enhanced perennial water (CDW 1997). Perennial water developed for livestock has created opportunity to establish additional isolated populations of the topminnow

Opportunities exist to continue reestablishing plains topminnow populations in waters on the Pawnee National Grassland. Past reintroduction efforts have been successful in many cases To be successful, all of these activities would require cooperation between the Forest Service and the Colorado Division of Wildlife.

4) Alternative Effects. Impacts of resource management on plains topminnows or their habitat are limited to effects of livestock grazing, oil and gas development, travel management and prescribed burning on the Grassland Overall effects of these activities on resource conditions have been described in the Environmental Impact Statement and Biological Evaluation/Biological Assessment Specific impacts to plains topminnows and their habitats are best described at the site specific project level, but most potential effects are mitigated by application of Forest Plan standards and the Watershed Conservation Practices under any of the alternatives

Amount of habitat available for plains topminnows is not expected to change under any of the alternatives analyzed for the *Forest Plan EIS.* There are a total of 15 to 35 acres of perennial aquatic habitat on the Grassland, some of which are occupied by topminnows (see Aquatic and Riparian Affected Environment in *FEIS*) Total acreage and use of topminnow habitat is primarily a function of annual climatic variation· when rainfall is abundant, larger amounts of habitat are present, when floods occur, distribution of topminnows across habitats may change, when drought occurs, populations of topminnows may be isolated and die.

Quality of habitat for topminnows is a function of natural conditions and whether habitat degradation occurs. Activities with potential to affect topminnow habitat are grazing, oil and gas development, travel management, or prescribed fire Grazing effects vary by alternative in relation to recommended sizes of proposed research natural areas or special interest areas where grazing practices might be altered In these cases, grazing would occur to benefit the unique environments included in those areas, including riparian areas or fish-bearing aquatic habitat for topminnows The "Assessment of the Effects of Livestock Grazing on the Sensitive Plains Fishes and Their Habitats for the Rocky Mountain Region" (USFS 1995b) describes habitat needs, grazing effects, and mitigation measures to protect plains topminnows The mitigation measures have been incorporated in the the WCP Handbook and are incorporated as Forest Plan standards by reference

Research natural areas and special interest areas vary from 763 acres (Alternative A) to 16,020 acres (Alternative H), with the preferred alternative allocating 12,104 acres (Alternative B) There would be variation in modified grazing objectives, but overall, conditions on grazed lands near plains topminnow habitat would remain stable to slightly improved

Oil and gas development effects are likely to vary more because of changes in the economy than by alternative Alternatives A, B, C, E, and I project approximately equal levels of development, and therefore reflect equal levels of risk to topminnow habitat Under Alternative H, additional areas would be withdrawn from exploration, so risks would be slightly reduced In any case, mitigation measures may be applied to relocate surface occupancy from sensitive areas, including riparian areas adjacent to fish-bearing aquatic habitats Thus, impacts from oil and gas development on plains topminnow would likely remain stable

Effects of travelway use and travel management on the Grassland are not likely to vary significantly by alternative. Travelway density at experienced budget levels is shown in Table 3 77 for the Grassland, and does not vary from 1.1 miles per square mile, except for Alternative H (0.9 miles per square mile). Travel management is focussed at reducing the number and mileage of redundant roads (duplicate roads that lead to the same windmill, for instance). The vast majority of these roads are located in upland areas and do not affect riparian or aquatic ecosystems, and visitor use on the Grassland is very light compared to other Front Range areas Thus, regardless of alternative selected, there would be no change in the low level of travelway impacts on topminnow habitat

Prescribed fire has been reintroduced to simulate natural conditions on the grassland. These relatively low severity fires are within the range of conditions that plains topminnows have evolved with. To date, fires have not occurred in proximity to riparian areas, but future burns are planned to manage vegetation to create more open water habitat in perennial potholes It is possible that these projects may result in changes to topminnow habitat, and while the degree of change is not known, risk is assumed to be relatively low These projects represent an opportunity to monitor changes in prairie riparian habitat through fire (Mark Ball, personal communication)

There are no known effects of insect and disease management on plains topminnows or their habitats, because these activities are limited to the Forests, where topminnows do not occur Use of pesticides or herbicides for pest management on the Grassland occurs in compliance with manufacturer's labelling, so risks of adverse effects on aquatic ecosystems are minimized in all cases. Structural stages on the Grassland are maintained overall, and there would be no expected change in topminnow habitats There are no known access or dispersal problems related to visitor uses.

5) Population Trends A determination of "may adversely impact individuals, but not likely to result in a loss of viability" for plains topminnow is documented in the biological evaluation for Alternative B (Appendix H) Plains topminnow habitats are expected to

remain approximately stable through time, regardless of what alternative is selected for implementation. Variation in habitat quantity and condition will be primarily from natural climatic conditions We assume that because there are no other significant threats to viability known, stable habitats should correlate with stable population trends Viability of plains topminnow populations on the Pawnee National Grassland should be retained

Plains Killifish

1) Management Indicator Community Plains killifish are a management indicator of the health of prairie aquatic ecosystems where they occur on the Pawnee National Grassland Habitats known to be occupied at this time include tributaries or mainstem portions of Crow Creek and Pawnee Creek.

2) Habitat. Plains killifish occur in perennial streams and isolated perennial potholes. Movement of fish is limited to rare high flow events (CDW 1997). This native minnow is relatively tolerant of the extreme habitat variation that occurs on the Grassland, and so is also relatively tolerant to management-derived changes in water quality (CDW 1985). Plains killifish are summer spawners, and spawning occurs over gravel bottoms, where the eggs are dropped. There is no parental care. This species feeds largely on the surface, taking primarily insects, but also is known to feed on bottom forms, feeding on insect larvae and plankton (Beckman 1963).

3) Habitat Effects Specific threats to plains killifish and their habitat are related to the limiting nature of perennial surface water on the Grassland. Available water on the Grassland is reused by multiple grazing and agricultural interests, which can lead to degraded water quality or complete absence of water. In addition, introduction of non-native game fish that prey on these native minnows has occurred in some areas and is not be advantageous. However, plains killifish were found to be abundant in Crow and Pawnee Creeks (as well as other prairie streams not included in the Grassland), so persistence appears to be strong (CDW 1997)

CDW identified restoration of historic streamflow as a potential opportunity to enhance conditions for native prairie fishes, including plains killifish, but recognized that this is probably not feasible Potential for fencing areas of riparian habitat was also identified as a means to provide recovery of a saturated water table that could provide more perennial water (CDW 1997)

4) Alternative Effects Impacts of resource management on plains killifish or their habitat are limited to effects of livestock grazing, oil and gas development, travel management and prescribed burning on the Grassland Overall effects of these activities on resource conditions have been described in the Environmental Impact Statement Specific impacts to plains killifish and their habitats are best described at the site specific project level, but most potential effects are mitigated by application of Forest Plan standards and the Watershed Conservation Practices under any of the alternatives.

Amount of habitat available for plains killifish is not expected to change under any of the alternatives analyzed for the *Forest Plan EIS* There are a total of 15 to 35 acres of perennial aquatic habitat on the Grassland, some of which are occupied by killifish (see Aquatic and Riparian Affected Environment in *FEIS*) Total acreage and use of killifish habitat is primarily a function of annual climatic variation· when rainfall is abundant, larger amounts of habitat are present; when floods occur, distribution of killifish across habitats may change; when drought occurs, populations of killifish may be isolated and die.

Quality of habitat for killifish is a function of natural conditions and whether habitat degradation occurs Activities with potential to affect killifish habitat are grazing, oil and gas development, travel management, or prescribed fire.

Grazing effects vary by alternative in relation to recommended sizes of proposed research natural areas or special interest areas where grazing practices might be altered In these cases, grazing would occur to benefit the unique environments included in those areas, including riparian areas or fish-bearing aquatic habitats Research natural areas and special interest areas vary from 763 acres (Alternative A) to 16,020 acres (Alternative H), with the preferred alternative allocating 12,104 acres (Alternative B) There would be variation in modified grazing objectives, but overall, conditions on grazed lands near plains killifish habitat would remain stable to slightly improved

Oil and gas development effects are likely to vary more because of changes in the economy than by alternative. Alternatives A, B, C, E, and I project approximately equal levels of development, and therefore reflect equal levels of risk to killifish habitat. Under Alternative H, additional areas would be withdrawn from exploration, so risks would be slightly reduced. In any case, mitigation measures may be applied to relocate surface occupancy from sensitive areas, including riparian areas adjacent to fish-bearing aquatic habitats Thus, impacts from oil and gas development on plains killifish would likely remain stable

Effects of travelway use and travel management on the Grassland are not likely to vary significantly by alternative Travel management is focussed at reducing the number and mileage of redundant roads (duplicate roads that lead to the same windmill, for instance) The vast majority of these roads are located in upland areas and do not affect riparian or aquatic ecosystems, and visitor use on the Grassland is very light compared to other Front Range areas Thus, regardless of alternative selected, there would be no change in the low level of travelway impacts on killifish habitat

Prescribed fire has been reintroduced to simulate natural conditions on the grassland These relatively low severity fires are within the range of conditions that killifish have evolved with. To date, fires have not occurred in proximity to riparian areas, but future burns are planned to manage vegetation to create more open water habitat in perennial potholes It is possible that these projects may result in changes to killifish habitat, and while the degree of change is not known, risk is assumed to be relatively low These projects represent an opportunity to monitor changes in prairie riparian habitat through fire (Mark Ball, personal communication)

- There are no known effects of insect and disease management on plains killifish or their habitats, because these activities are limited to the Forests, where killifish do not occur. Use of pesticides or herbicides for pest management on the Grassland occurs in compliance with manufacturer's labelling, so risks of adverse effects on aquatic ecosystems are minimized in all cases. Structural stages on the Grassland are maintained overall, and there would be no expected change in killifish habitats. There are no known access or dispersal problems related to visitor uses.

5) Population Trends Plains killifish habitats are expected to remain approximately stable through time, regardless of what alternative is selected for implementation. Variation in habitat quantity and condition will be primarily from natural climatic conditions. We assume that because there are no other significant threats to viability known, stable habitats should correlate with stable population trends. Viability of plains killifish populations on the Pawnee National Grassland should be retained.

ENDANGERED AND THREATENED SPECIES

These are Federal and State listed species that may be affected by land and resource management, and are not already selected for management indicator communities Included are the six species that are listed in sections II A. and B of this analysis

1-2) Management Indicator Community & Habitat These species are indicative of the habitat conditions that they occupy. See the biological assessment and biological evaluation (Appendices I and H, respectively) for discussion of habitats and threats

3-5) Habitat Effects, Alternative Effects & Population Trends Effects to these species are not expected to vary by alternative even though risk varies with planned management by alternative. Each alternative will at least maintain the viability of these species This is based on the Biological Assessment (*FEIS* - Appendix I), the Biological Evaluation (*FEIS* - Appendix H), the Viability Assessments (*FEIS* - Chapter Three - Mountains and Plains - Terrestrial Habitat and Wildlife - Fine Scale Overview) and direction in Chapters One, Two and Three (*Forest Plan*) that assures maintenance and improvement of wildlife habitat

IV. Monitoring of Management Indicator Habitats and Species

Management indicator species and their habitats are monitored through a variety of means Emphasis on monitoring under the revised *Forest Plan* will be on continued use of existing data sources and expansion of monitoring responsibility to external stakeholders when possible. Monitoring is targeted, rather than broad and all inclusive Monitoring of habitats on the Forests and Grassland will be linked, when possible, to information on population trends from Colorado Division of Wildlife (CDW), US Fish and Wildlife Service and other sources

This section describes general methodology and sources. Other information on Monitoring and

Evaluation is found in Chapter Four (*Forest Plan*).

Throughout time, terrestrial species of the Forests and Grassland have been associated with non-human caused disturbances (USDA 1996). Populations have always been dynamic, varying with the amount and type of disturbances. Because human influence near and within the Forests and Grassland, certain populations are also affected by human disturbances While habitat is fundamental to the species that occur, their populations are also affected by many other factors such as natality, fatality, weather events, predation, disease and hunting that are beyond Forest Service management. This makes the monitoring of populations in relation to habitat conditions and changes challenging. Monitoring efforts will contribute to assessing population trends across the entire planning unit (ARNFs and PNG).

Mammals and their habitats, particularly large mammals and game species, are monitored by the CDW (Steve Steinert, 1997 - personal communications) There are cooperative working relationships in place between agencies whereby the Forest receives population information on a regular basis. Some examples of these are

- Annual CDW Official Harvest Statistics. These include population estimates by Data Analysis Unit for big game Animals in these estimates include deer, elk, antelope, moose, black bear, lion, bighorn sheep and mountain goat.
- Unit management plans and updated population estimates for specific animals, such as elk management plans for defined game management units within the Forests and Grassland.
- The Wildlife Resource Information System which also includes habitat information such as migration routes and winter range locations

CDW allows Forest Service access to many other sources of animal population data. New and ongoing game bird, raptor, neo-tropical migrant birds, amphibian, small mammal and fish studies and surveys are examples. These sources will continue to be used as appropriate.

Amphibian populations and habitat are monitored by the CDW They are monitoring several populations of amphibians across the Forests and Grassland, and continually searching for new populations In time based on the current amount of activity by CDW, the entire Forest and Grassland should have information on all existing amphibian populations and their status There should also be information on areas where activities like transplants can take place Other sources for general amphibian information include the Frog Log, an international amphibian monitoring and information sharing formal network The Colorado Natural Heritage Program (CNHP) data base will also be used as a source for identifying where amphibian populations exist

Aquatic habitats on the Grassland are variable. From year to year prairie ponds and streams may or may not contain water depending on weather cycles The abundance of live water habitats is monitored informally by Grassland personnel during normal administrative duties Grassland personnel also monitor locations of successful populations and reintroductions and record qualitative information on population redistribution following floods. More quantitative population surveys are conducted in cooperation with CDW on a recurring basis

Perennial aquatic habitats on the Forests are more stable. More specific aquatic habitat quantity and quality information is collected by Forest personnel during programmatic inventories or during planning for specific management activities. Aquatic populations on the Forests and Grassland are monitored broadly by CDW basis, with site specific inventories conducted by CDW, Forest Service, university students, or private entities on a less frequent basis. Future monitoring will emphasize more consistent use of peer-reviewed methods of quantifying aquatic habitats

Non-game species will be monitored to the extent possible using available Colorado State University, USFWS, and CNHP studies and data If information does not exist or is not otherwise available, then populations and habitat will be monitored as efficiently as possible by other means. Partnership efforts with other agencies, organizations, universities or groups will be used whenever possible to optimize monitoring results with available funding and personnel

SECTION 2 - LIST OF THREATENED, ENDANGERED AND SENSITIVE SPECIES (1997).

Arapaho and Roosevelt National Forests

SPECIES CURRENTLY DOCUMENTED TO OCCUR ON NFS LANDS

Endangered

Birds

American peregrine falcon *Falco peregrinus anatum*

Threatened

Birds

bald eagle *Haliaeetus leucocephalus*

Fish

greenback cutthroat trout *Oncorhynchus clarki stomias*

Proposed

Mammals

Prebble's meadow jumping mouse *Zapus hudsonius preblei*

Sensitive

Birds

common loon *Gavia immer*
northern goshawk *Accipiter gentilis*
ferruginous hawk *Buteo regalis*
osprey *Pandion haliaetus*
merlin *Falco columbarius*
American bittern *Botaurus lentiginosus*
white-faced ibis *Plegadis chihi*
greater sandhill crane *Grus canadensis*
long-billed curlew *Numenius americanus*
black tern *Chlidonias niger*
western burrowing owl *Athene cunicularia*
boreal owl *Aegolius funereus*
flammulated owl *Otus flammeolus*
black swift *Cypseloides niger*
Lewis' woodpecker *Melanerpes lewis*
northern three-toed woodpecker *Picoides tridactylus*
olive-sided flycatcher *Contopus borealis*
pygmy nuthatch *Sitta pygmaea*
golden-crowned kinglet *Regulus satrapa*
loggerhead shrike *Lanius ludovicianus*
fow sparrow *Passerella iliaca*
purple martin *Progne subis*

Mammals

dwarf shrew *Sorex nanus*
pygmy shrew *Microsorex hoyi montanus*
Townsend's big-eared bat *Plecotus townsendii*

ringtail *Bassariscus astutus*
marten *Martes americana*

Amphibians
tiger salamander *Ambystoma tigrinum*
boreal western toad *Bufo boreas boreas*
northern leopard frog *Rana pipiens*
wood frog *Rana sylvatica*

Reptiles
lined snake *Tropidoclonion lineatum*

Fish
Colorado River cutthroat trout *Oncorhyncus clarki pleuriticus*
flathead chub *Hybopsis gracilus*
plains topminnow *Fundulus sciadicus*

Invertebrates
Rocky Mountain capshell snail *Acroloxus coloradensis*
lost ethmiid moth *Ethmia monachella*
Steven's tortricid moth *Decodes stevensi*

Plants
Colorado aletes *Aletes humilis*
sea pink *Armeria maritima*
prairie moonwort *Botrychium campestre*
reflected moonwort *Botrychium echo*
pale moonwort *Botrychium pallidum*
livid sedge *Carex livida*
clustered lady's-slipper *Cypripedium fasciculatum*
Hall's fescue *Festuca hallii*
alpine feverfew *Parthenium alpinum*
Front Range cinquefoil *Potentilla effusa var. rupincola*
northern blackberry *Rubus arcticus*

SPECIES OR HABITAT SUSPECTED TO OCCUR ON NFS LANDS, BUT UNCONFIRMED

Threatened

Birds
Mexican spotted owl *Strix occidentalis lucida*

Sensitive

Mammals
North American wolverine *Gulo gulo luscus*
North American lynx *Felis lynx canadensis*

Fish
banded killifish *Fundulus diaphanus*

Plants
dwarf milkweed *Asclepias uncialis*
Weber's scarlet-gilia *Ipomopsis aggregata weberi*
Adder's-mouth *Malaxis monophylos brachypoda*

Weber's monkey-flower *Mimulus gemmiparus*
autumn willow *Salix serissima*
slender moonwart *Botrychium lineare*

SPECIES MAY NOT OCCUR ON NFS LANDS, BUT MAY BE IMPACTED BY FS MANAGEMENT ACTIONS (applies only to federally listed species)

Endangered

Birds

least tern *Sterna antillarum*
piping plover *Charadrius melodus*
whooping crane *Grus americana*

Fish

bonytail chub *Gila elegans*
Colorado squawfish *Ptychocheilus lucius*
humpback chub *Gila cypha*
razorback sucker *Xyrauchen texanus*

Invertebrates

American burying bettle *Nicrophorus americanus*

Threatened

Plants

western prairie fringed orchid *Platanthera praeclara*
Ute ladies-tresses *Spiranthes diluvialis*

SPECIES CURRENTLY FOUND WITHIN VICINITY OF NFS LANDS, OTHERWISE NOT KNOWN TO BE PRESENT ON NFS

Endangered

Plants

Osterhout milk-vetch *Astragalus osterhoutii*

Threatened

Invertebrates

Pawnee montane skipper *Hesperia leonardus montana*

Sensitive

Birds

western yellow-billed cuckoo *Coccyzus americanus*

Mammals

fringed-tailed myotis *Myotis thysanodes pahasapensis*

Plants

Colorado butterfly weed *Gaura neomexicana coloradoensis*
narrow-leaved moonwart *Botrychium lineare*

SPECIES IS LIKELY TO BE EXTIRPATED FROM NFS LANDS, HISTORICAL OCCURRENCES DOCUMENTED ON NFS OR IN VICINITY OF NFS

Endangered

Mammals

black-footed ferret *Mustela nigripes*

Rocky Mountain gray wolf *Canis lupus irremotus*

Threatened

Mammals

grizzly bear *Ursus arctos horribilis*

Pawnee National Grassland

SPECIES CURRENTLY DOCUMENTED TO OCCUR ON NFS LANDS

Endangered

Birds

American peregrine falcon *Falco peregrinus anatum*

Threatened

Birds

bald eagle *Haliaeetus leucocephalus*

Sensitive

Birds

common loon *Gavia immer*

ferruginous hawk *Buteo regalis*

osprey *Pandion haliaetus*

merlin *Falco columbarius*

white-faced ibis *Plegadis chihi*

mountain plover *Charadrius montanus*

long-billed curlew *Numenius americanus*

upland sandpiper *Bartramia loicauda*

black tern *Chlidonias niger*

western yellow-billed curlew *Coccyzus americanus*

western burrowing owl *Athene cunicularia*

olive-sided flycatcher *Contopus borealis*

purple martin *Progne subis*

golden-crowned kinglet *Regulus satrapa*

loggerhead shrike *Lanius ludovicianus*

Baird's sparrow *Ammodramus bairdii*

fox sparrow *Passerella iliaca*

Mammals

dwarf shrew *Sorex nanus*

swift fox *Vulpes velox*

Amphibians

tiger salamander *Ambystoma tigrinum*

northen leopard frog *Rana pipiens*

Reptiles
yellow mud turtle *Kinosternon flavescens flavescens*
Fish
plains topminnow *Fundulus sciadicus*
Plants
alpine feverfew *Parthenium alpinum*

SPECIES OR HABITAT SUSPECTED TO OCCUR ON NFS LANDS, BUT UNCONFIRMED

Sensitive

Birds
American bittern *Botaurus lentiginosus*
Lewis' woodpecker *Melanerpes lewis*
Mammals
fringed-tailed myotis *Myotis thysanodes pahasapensis*
Prebel's meadow jumping mouse *Zapus hudsonius preblei*
Invertebrates
regal fritillary butterfly *Speyeria idalia*
Albarufan dagger moth *Acronicta albarufa*
lost ethmiid moth *Ethmia monachella*
Plants
dwarf milkweed *Asclepias uncialis*
Colorado butterfly weed *Gaura neomexicana coloradoensis*

SPECIES MAY NOT OCCUR ON NFS LANDS, BUT MAY BE IMPACTED BY FS MANAGEMENT ACTIONS (applies only to federally listed species)

Endangered

Birds
Eskimo curlew *Numemius borealis*
whooping crane *Grus americanus*

SPECIES IS LIKELY TO BE EXTIRPATED FROM NFS LANDS, HISTORICAL OCCURRENCES DOCUMENTED ON NFS OR IN VICINITY OF NFS

Endangered

Mammals
black-footed ferret *Mustela nigripes*
Rocky Mountain gray wolf *Canis lupus irremotus*

Threatened

Mammals
grizzly bear *Ursus arctos horribilis*

SECTION 3 -LIST OF SIGNIFICANT NATURAL COMMUNITIES AND RARE SPECIES (OTHER THAN TES) BY COLORADO NATURAL HERITAGE PROGRAM (July 1995).

NATURAL HERITAGE RANKS

The following ranks are used by the Colorado Natural Heritage Program to set protection priorities for natural heritage resources Natural Heritage Resources (NHRs) are rare, threatened or endangered plant and animal species, rare and exemplary natural communities, and significant geologic features. The primary criterion for ranking NHRs is the number of populations or occurrences, i.e the number of known distinct localities. Also of great importance is the number of individuals in existence at each locality or, if a highly mobile organism (e g large mammals, many birds, and butterflies), the total number of individuals Other considerations may include the quality of the occurrences, the number of protected occurrences, and threats However, the emphasis remains on the number of populations or occurrences such that ranks will be an index of known biological rarity.

S1 Extremely rare, usually 5 or fewer populations or occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.

S2 Very rare,usually between 5 and 20 populations or occurrences, or with many individuals in fewer occurrences, often susceptible to becoming extirpated

S3 Rare to uncommon, usually between 20 and 100 populations or occurrences, may have fewer occurrences, but with a large nubmer of individuals in some populations; may be susceptible to large-scale disturbances

S4 Common; usually >100 populations or occurrences; may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats

S5 Very common, demonstrably secure under present conditions

SA Accidental in state.

S#B Breeding status of an organism in the state

SH Historically known from the state, but not verified for an extended period, usually > 15 years, this rank is used primarily when inventory has been attempted recently

S#N Nonbreeding status within the state Usually applied to winter resident species

SU Status uncertain, often because of low search effort or cryptic nature of the element.

SX Apparently extirpated from the state.

SZ Long distance migrant whose occurrences are too irregular, transitory and/or dispersed to be reliably identified, mapped and protected.

S? Believed to be rare but awaiting formal rarity ranking

Global ranks are similar, but refer to a species' rarity throughout its total range. Global ranks are denoted with a "G" followed by a character. Note that GA and GN are not used and GX means apparently extinct A "Q" in a rank indicates that a taxonomic question concerning that species exists. Ranks for subspecies are denoted with a "T " The global and state ranks combined (e g G2/S1) give an instant grasp of a species' known rarity

ARAPAHO AND ROOSEVELT NATIONAL FORESTS

	Global Rank	State Rank
Natural Communities		
Western slope sagebrush shrublands *Artemisia cana/Festuca thurberi*	G2G3	S2S3
Mixed foothill shrublands *Artemisia tridentata wyomingensis/Leymus ambiguus*	G3	S2
Xeric sagebrush shrublands *Artemisia tridentata wyomingensis/ Pseudoroegneria spicata*	G5	S3?
Mixed foothill shrublands *Artemisia tripartita/Festuca idahoensis*	G4G5	S1?
Mixed foothill shrublands *Artemisia tripartita/Festuca idahoensis*	GU	SU
Montane wet meadows *Carex aquatilis/Carex rostrata*	G?	S2S3
Quaking fen *Carex diandra*	G?	S?
Montane wet meadows Carex rostrata	G5	S3
Alpine meadows *Carex rupestris/Geum rossii*	G4	S4
Mixed foothill shrublands *Cercocarpus montanus/Stipa comata*	G2	S2
Montane grasslands *Danthonia parryi*	G2?	S2?
Mesic alpine meadows *Deschampsia cespitosa/Grum rossii*	G5	S5
Foothills pinyon-juniper woodlands/scarp *Juniperus scopilorum/ Cercocarpus montanus*	G2	S2
Foothills pinyon-juniper woodlands *Juniperus scopulorum/ Purshia tridentata*	G2	S2
Alpine meadows *Kobresia myosuroides-geum rossii*	G5	S5
Montane grasslands *Muhlenbergia montana/Stipa comata*	G2	S2
Alpine fellfields *Paronychia pulvinata/Silene acaulis var subacaulis*	G5	S5
Alpine wetlands *Phippsia algida*	GU	SU
Picea engelmannii/Calanmgrostis canadensis	G3	SU
Montane riparian forests *Picea pungens/Alnus incana*	G3	S3
Upper montane woodlands *Pinus aristata/Trifolium dasyphyllum*	G2	S2
Seral lodgepole pine forests *Pinus contorta/Vaccinium scorparium*	G5	S4

	Global Rank	State Rank
Natural Communities		
Foothills ponderosa savannas *Pinus ponderosa/Leucopoa kingii*	G2	S2
Montane riparian forests *Populus angustifolia/alnus incana*	G?	S?
Montane grasslands *Pseudoroegneria spicata/Poa secunda*	G4	S1
Mixed foothill shrublands *Purshia tridentata/Muhlenbergia montana*	G1G2	S1S2
Mixed foothill shrublands *Purshia tridentata/Stipa comata*	G1G2	S1S2
Montane willow carrs *Salix geyeriana/Salix monticola/ Calamagrostis canadensis*	G3	S3
Montane willow carr *Salix monticola/Calamagrostis canadensis*	GU	SU
Montane willow carrs *Salix planifolia/Salix brachycarpa/ caltha leptosepala*	G4	S4
Montane willow carrs *Salix planifolia/Calamagrostis canadensis/ carex aquatilis*	G2G4	S2S4
Subalpine riparianwillow carr *Salix wolfii/Calamagrostis canadensis*	G3	S1
Fish		
Johnny darter *Etheostoma nigrum*	G5	S3
Iowa darter *Etheostoma exile*	G5	S2
Birds		
White-winged crossbill *Loxia leucoptera*	G5	S1B, SZ
Invertebrates		
Lake darner *Aeshna eremita*	G5	S1
Green-striped darner *Aeshna verticalis*	G5	S?
Least skipperling *Ancyloxpha numitor*	G5	S1S2
Arogos skipper *Atrytone arogo*	G4	S2
River jewelwing *Caloperyx aequabilis*	G5	SH
American emerald *Cordulia shurtleffi*	G5	S1?
Theano alpine *Erebia theano*	G4	S3
Mottled dusky wing *Erynnis martialis*	G4	S2S3
Moss's elfin *Incisalia mossi*	G4	S2S3
Edith's copper *Lycaena editha*	G5	S2S3
Rocky Mountain arctic jutta *Oeneis jutta reducta*	G5TU	S1
Polixenes arctic *Oeneis polixenes*	G5	S3
Sharp sprite *Promenetus exacuous*	G?	S2
Hudsonian emerald *Somatochlora hudsonica*	G5	S2S3
Ocellated emerald *Somatochlora minor*	G5	S1
Vascular Plants		
Lavendar hyssop *Agastache foeniculum*	G4G5	S1
Alpine aster *Aster alpinus var veirhapperi*	GUTU	S1

	Global Rank	State Rank
Vascular Plants		
Western moonwort *Botrychium hesperium*	G3	S2
Lance-leaved moonwort *Botrychium lanceolatum var lanceolatum*	G5T4	S2
Moonwort *Botrychium lunaria*	G5	S2
Mingan moonwort *Botrychium minganense*	G4	S2
Leathery grape fern *Botrychium multifidum*	G5	S1
Round-headed sedge *Carex capitata ssp arctogena*	G5T4?	S1
Carex diandra	G5	S1
Slender sedge *Carex lasiocarpa*	G5	S1
Bristle-stalk sedge *Carex leptalea*	G5	S1
Mud sedge *Carex limosa*	G5	S2
A sedge *Carex oreocharis*	G3	S1
Peck sedge *Carex peckii*	G4G5	S1?
Many-headed sedge *Carex sychnocephalia*	G4	S1?
Rocky Mountain snowlover *Chinophila jamesii*	G4?	S3S4
Dwarf hawksbeard *Crepis nana*	G5	S2
Yellow lady's-slipper *Cypripedium pucescens*	G5	S2
Mountain bladder fern *Cystopteris montana*	G5	S1
Clawless draba *Draba exunguiculata*	G3	S2
Arctic draba *Draba fladnizensis*	G4	S2S3
Gray's Peak whitlow-grass *Draba grayana*	G2	S2
Prosild draba *Draba porsildii*	G3	S1
Colorado divide whitlow-grass *Draba streptobrachia*	G3	S3
Spreading wood fern *Dryopteris expansa*	G5	S1
Tall fleabane *Erigeron elatior*	G3	S3
Low fleabane *Erigeron humilis*	G4	S1
Black-headed fleabane *Erigeron melanocephalus*	G3	S3
Pinnate fleabane *Erigeron pinnatisectus*	G3	S3
Slender cotton grass *Eriophorum gracile*	G5	S2
Dwarf rattlesnake-plantain *Goodyera repens*	G5	S2
Vasey bulrush *Juncus vaseyi*	G3G5	S1
Gay-feather *Liatris ligulistylis*	G5?	S1S2
Slender-leaf ligusticum *Ligusticum tenuifolium*	G5	S1?
Wood lily *Lilium philadelphicum*	G5	S3
Northern twayblade *Listera borealis*	G4	S2
Broad-leaved twayblade *Listera convallarioides*	G5	S2
Stiff clubmoss *Lycopodium annotinum var pungens*	G?Q	SU
Alpine poppy *Papaver lapponisum spp occidentale*	G3Q	S2
Koetzebue grass-of-Parnassus *Parnassia kotzebuei*	G4	S1
Larch-leaf beardtongue *Penstemon laricifolius spp exilifolius*	G4T3	S1
Snow grass *Phippsia algida*	G5	S2
Southern Rocky Mountain cinquefoil *Potentilla ambigens*	G3	S1S2

	Global Rank	State Rank
Vascular Plants		
Tundra buttercup *Ranunculus karelinii*	G4	S2
White-flowered azalea *Rhododendron albiflorum*	G4	S2
Hoary or silver willow *Salix candida*	G5	S2
Tundra saxifrage *Saxifraga cespitosa spp monticola*	G5T5	S1
Leafy saxifrage *Saxifraga foliolosa*	G4	S1
Western wake-robin *Trillium ovatum*	G4?	S2

PAWNEE NATIONAL GRASSLAND

	Global Rank	State Rank
Natural Communities		
Shortgrass prairie *Atriplex canescens/Bouteloua gracilis*	G3	S3
Great Plains salt meadows *Distichlis spicata var stricta*	G4	S3
Scarp woodlands *Juniperus scopulorum/Schizachyrium Scoparium*	G3	S2S3
Vertebrates		
Blanchard's cricket frog *Acris crepitans blanchardi*	G5T5	S2
Iowa darter *Etheostoma exile*	C5	S2
Bushy-tailed woodrat subspecies *Neotoma cinerea rupincola*	G5T?	S2
Vascular Plants		
Mountain cat's-eye *Cryptantha cana*	G5	S2