Management Indicator Species Specialist Report

For the

Hazard Tree and Fuels Reduction Project–
Routt National Forest (NF) Portion and Those Acres of the Arapaho-Roosevelt National Forest Administered by the Routt NF
Of the Medicine Bow – Routt NF's Hazard Tree/Fuels Reduction Project.

This includes the Parks, Hahn's Peak/Bears Ears and Yampa Ranger Districts located throughout Garfield, Grand, Jackson, Moffat, Rio Blanco and Routt Counties

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Prepared by: _____ Date:_____
Marcia L. Pfleiderer, Parks Ranger District Wildlife Biologist

Introduction

The USDA Forest Service (FS) is proposing an array of treatments to address *hazardous trees and fuel loading that include lodgepole pine, Engelmann spruce, sub-alpine fir and aspen throughout the Routt National Forest, which lies within the counties of: Garfield, Grand, Jackson, Moffat, Rio Blanco, and Routt. This project excludes wilderness areas. The majority of the treatments would impact lodgepole pine.

Consistency Determination between the Proposed Action(s) and Wildlife Standards Described in the Routt National Forest Plan

All activities, as embodied in the proposed action described above, are planned consistent with applicable Forest-wide threatened, endangered, sensitive species (TES) and wildlife standards defined within the *Routt National Forest Land and Resource Management Plan* (USDA 1997, p. 1-14 and 1-15). The proposed action is also consistent with the desired conditions for wildlife habitat specific to the Forest-Level, Management Area, and Geographic Area Direction as long as site-specific Wildlife Conservation Measures/ Project Design Criteria have been incorporated into the proposed action and these measures support the requirements and goals and objectives of the wildlife direction defined within the *Plan*.

The best available science was used in analysis, including references at the end of this document.

A Biological Evaluation and Biological Assessment have been completed for this project and can be located in the final Environmental Assessment document.

Note: Amphibian, fish, and plant species are considered in separate biological evaluations prepared by the Fisheries Biologist and Botanist.

PURPOSE & NEED

The HFRA recognizes forest health as an integral part of forest management. The Proposed Action responds directly to forest health objectives as described in the HFRA.

Based on Forest Plan direction and a comparison of the analysis area's existing condition versus its desired condition, the Forest Service has identified the following resource needs:

The purpose of this project is to: 1) manage forest vegetation affected by the mountain pine beetle epidemic; and 2) to reduce threats to public safety by felling and/or removing trees that are dead and dying along roads and trails, in and adjacent to Forest Service developed recreation sites (campgrounds, trailheads, etc.), and in and adjacent to Forest Service administrative sites.

The project is needed to:

- Ensure public and firefighter safety by keeping travel corridors open with adequate clearance for the combination of traditional firefighting equipment, such as heavy equipment transport trucks, crew carriers, busses, fire engines, recreational vehicles, and automobiles. The combination of such vehicles is typical during an emerging fire emergency when fire resources are arriving and the general public is evacuating.
- Reduce the hazard to public safety due to the risk of dead and dying trees falling;
- Reduce the risk of high intensity/high severity wildfires within treatment areas by reducing hazardous fuel loadings associated with treatments and beetle killed trees;
- Minimize the effects of tree mortality on the overall health, scenic quality, and condition of forested areas along roads, developed recreation sites, and administrative sites; and
- Partially offset the cost of treatments by salvaging forest products.

PROJECT BACKGROUND AND DESCRIPTION OF THE PROPOSED ACTION

PROJECT BACKGROUND

While bark beetles are always present in low numbers, recent years have seen a dramatic increase in bark beetle activity and conifer tree mortality on the Medicine Bow-Routt National Forests. The current mountain pine beetle infestations and their impact on lodgepole pine forests have likely been influenced by a number of factors, including: 1) an abundance of older, dense, large diameter lodgepole pine stands; 2) prolonged drought; 3) earlier melting of the smaller, drought-influenced snowpacks, resulting in extended and more severe drought conditions; 4) higher temperatures, allowing for an expansion of the one-year mountain pine beetle lifecycle into areas of lodgepole pine forests at higher elevations (>9,500 feet elevation); and 5) greater survival of mountain pine beetle broods in the high elevation lodgepole pine forests. Unless a period of prolonged and severe low temperatures (<-30° F) occurs during late fall-winter-early spring months, the beetle epidemic is likely to continue and increase.

The extent and numbers of beetle-caused mortality can pose significant threats to public safety for a variety of reasons. For example, there is an increased risk: 1) for persons or property being struck by falling trees; 2) of wildland fire from lightening striking dead trees vs. live green trees; 3) for more catastrophic fire events due to increased fuel loads; and 4) of trees falling and blocking roadways, thus preventing both emergency and non-emergency ingress and egress. All of these factors can be mitigated by the removal of dead and dying trees along roadways and trails and in areas that receive concentrated public use.

PROPOSED ACTION

Under the Modified Proposed Action, standing dead and dying trees that are within 1 ½ tree heights (up to 150 feet) from the centerline of: 1) state and county roads that cross the Forest; and 2) Forest Service system roads open to public travel (Maintenance levels 2 – 5) would be felled and/or removed. Standing dead and dying trees in and adjacent to Forest Service campgrounds, administrative sites, and Forest Service trailheads would also be felled and/or removed; standing dead and dying trees would be felled, but not removed, along Forest Service trails. Healthy, stable, live trees and dead and dying trees leaning away from the roads and trails and other aforementioned sites would be retained unless the dead trees pose a safety hazard in the felling/removal operation.

The majority of the treatments would impact lodgepole pine trees, although small amounts of Engelmann spruce, sub-alpine fir, and aspen could also be felled and/or removed. Depending on the severity of the infestation and the resultant mortality, harvest treatments could include clearcutting, patch clearcutting, overstory removal, thinning, and group selection. (*Refer to the LRMP, FEIS, Glossary for a definition of harvest treatments.)* In these situations, forest products would be removed (where feasible) or fuels would be treated on site. Fuel treatments could include chipping, lopping and scattering slash to an 18 or 24 inch depth, roller chopping, machine trampling, and/or broadcast burning. Hand piling, pile burning or mulching may occur in select units to mitigate fuels or visual concerns.

Small personal use sales, timber sales, free personal use and administrative use permits, Forest Service crews, service contracts, and Stewardship contracts are all examples of instruments that could be used to implement the hazard tree removal project.

Design criteria would be applied to protect sensitive areas, such as streamside management zones. Priority for scheduling treatment would be determined by the severity of bark beetle infestation, mortality of trees, and the severity of safety hazard posed.

Following is a summary of the roads and trails potentially affected by this project:

Acres potentially affected:

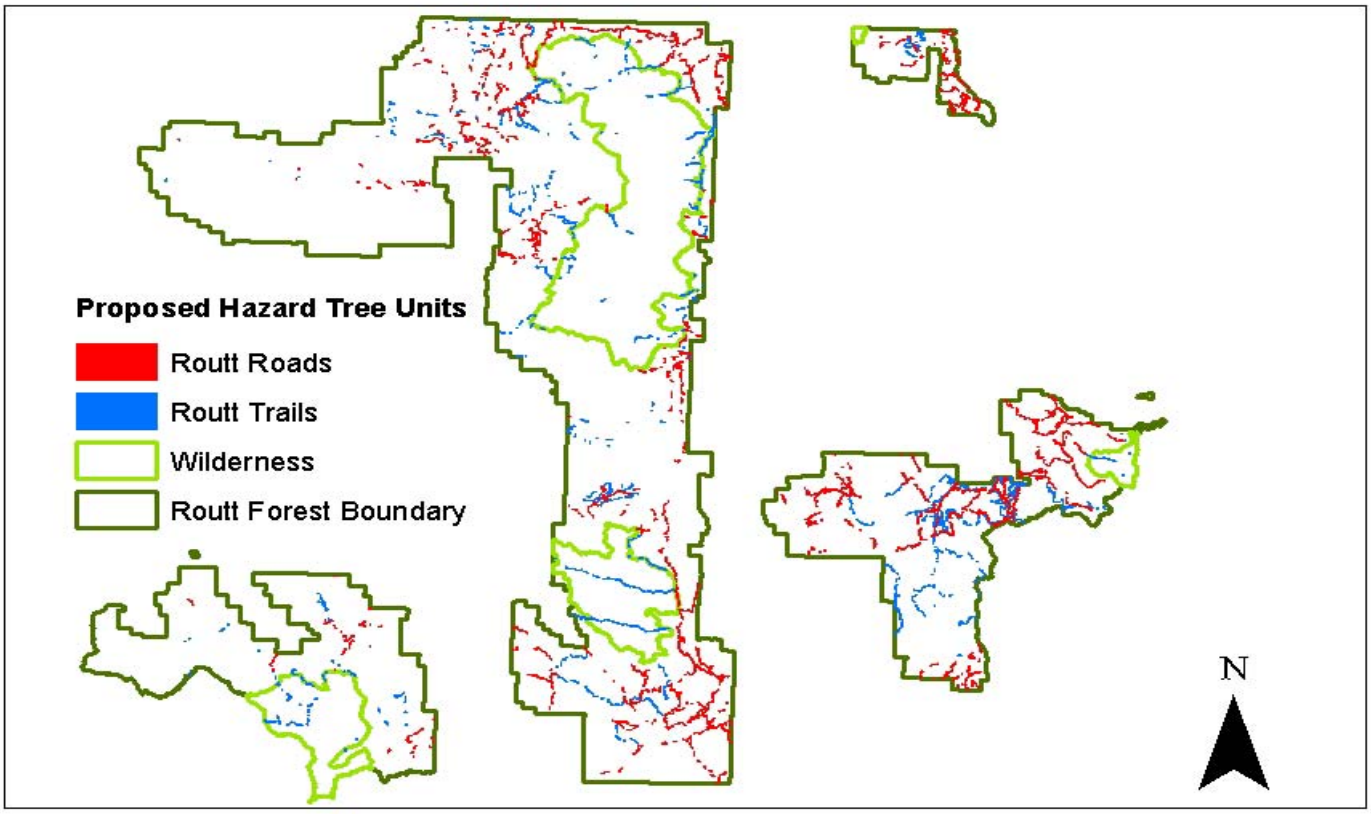
Along roads, approximately 10,932 acres on the Routt portion of the Forest could be affected by project implementation.

Along trails, approximately 7,368 acres on the Routt portion of the Forest could be affected by project implementation.

Miles of road potentially affected: 817 on the Routt

Miles of trail potentially affected: 720 on the Routt

Map of the Proposed Action Area



Project Design Criteria

The action alternatives for this project were developed with the inclusion of project design criteria as fundamental and integral to the design of the action alternatives. The Environmental Assessment lists all of the design criteria associated with the action alternatives. Some design criteria developed by other resource specialists also serve to protect the wildlife and fisheries resources, such as the best management practices for watershed and soils protection.

This section briefly describes nine design criteria specifically developed for the management and protection of the wildlife and fisheries resources that ensure consistency with the Forest Plan. A complete and detailed description of these, project level design criteria are included in *Appendix B* of the Wildlife Biological Evalutaion. Also *Appendix A,* located in the Biolocial Evaluation, lists the general Hazard Tree Design Criteria.

Design Criteria for Snag Retention: Snags are important for many species of wildlife and snag retention is included in the project design to ensure that these important habitat components are retained for the wildlife species that need these structures. The snag retention design criteria that were developed are consistent with the direction provided in the Forest Plan: Biological Diversity Standards 1 and 2 (p. 1-8); 5.11 Vegetation Standard 2 (p.2-40); 5.13 Vegetation Guideline 4 (p. 2-45).

Design Criteria for Live ('Character') Tree Retention: Live tree retention design criteria were developed to ensure that snags will be present on the landscape over the long-term. Live 'character' trees will act as replacement snags to ensure that the important habitat structures provided by snags are maintained over the long-term and available as the new forest developed following management. Additionally, anticipated loss (cutting or natural collapse) of live reserve trees will provide for meeting Forest LRMP standards for retention of coarse woody debris. The live tree retention design criteria was established to ensure consistency with the following Forest Plan direction: Biological Diversity Standards 1 (p. 1-8); 5.11 Vegetation Standard 3 (p.2-40); 5.13 Vegetation Standard 2 (p. 2-45).

Design Criteria for the Protection of Known Goshawk Nest Stands (identified before award of timber sale contract): The protection of known goshawk nest stands is necessary to ensure that this species is not impacted to a degree that may affect its species viability or cause a reduction in the Forest population. A criterion was developed that is specific to goshawks because of this species specific nesting requirements within forested landscapes. This project design criteria was established to ensure consistency with the following Forest Plan direction: TES Standards 6, 7 and 8 (p. 1-14); General Technical Report RM-217; Management Recommendations for the Northern Goshawk in the Southwestern United States (Reynolds et al. 1992).

Design Criteria for the Protection of Raptor Nesting Sites (identified before award of timber sale contract and all species other than goshawks): The protection of raptor nest sites is critical to maintain raptor populations. This criterion was developed for raptor nesting areas other than those of the northern goshawk. This project design criteria was established to ensure consistency with the following Forest Plan direction: TES Standards 6, 7 and 8 (p. 1-14).

Design Criteria for Raptor Nesting Period Seasonal Restriction in Logging Operations: Because many raptor species are sensitive to disturbance, seasonal restrictions have been developed to reduce disturbance to nesting raptors within the project area. This project design criteria was established to ensure consistency with the following Forest Plan direction: TES Standards 6, 7 and 8 (p. 1-14); General Technical Report RM-217; Management Recommendations for the Northern Goshawk in the Southwestern United States (Reynolds et al. 1992).

Design Criteria for Monitoring of Goshawk Nest Locations during Implementation: The intent of this criterion is to ensure that if goshawk nest sites change in location from year to year, that those changes are discovered and can be incorporated into consideration and ensure appropriate management changes are made that will avoid unacceptable impacts. This project design criteria was established to ensure consistency with the following Forest Plan direction: TES Standards 6, 7 and 8 (p. 1-14); General Technical Report RM-217; Management Recommendations for the Northern Goshawk in the Southwestern United States (Reynolds et al. 1992).

Design Criteria for Protection of Newly Discovered Goshawk Nests and other critical TES Habitats/Sites Identified after the Award of the Timber Sale or other Treatment Contract: This project design criteria was established to ensure that critical TES habitats are protected following the aware of the timber sale contract. This criterion ensures consistency with the following Forest Plan direction and laws: TES Standards 6, 8 and 9 (p. 1-14); The Endangered Species Act of 1973; Timber sale contracting authorities.

Design Criteria for Conservation of Old-growth Lodgepole Pine: This criterion was established to ensure the maintenance of the unique habitat provided by old-growth lodgepole pine to sensitive wildlife species. This project design criteria was established to ensure consistency with the following Forest Plan direction: Late Successional Forests 1 (p. 3-76); Forest Goal 1 (Ecosystem Management)**;** Objective described at the 6th "bullet" (p. 1-2).

Design Criteria for Conservation of Coarse Woody Debris

Coarse woody debris is an important habitat component for wildlife including several sensitive species. Additionally coarse-woody debris is important for ecosystem function and maintenance of soil and watershed health, which also benefits wildlife and fish species. This project design criteria was established to ensure consistency with the following Forest Plan direction: Biological Diversity Standard 1 (p. 1-8).

Analysis Schedule

It is anticipated that hazard tree reduction projects would begin as early as the spring/summer of 2008. The Forest Supervisor for the Medicine Bow-Routt National Forests is the Responsible Official for this proposal.

EXISTING CONDITION

Aerial surveys conducted annually for the Medicine Bow-Routt National Forests show that losses of lodgepole pine to mountain pine beetles have increased significantly in

extent and number over the past 11 years. For example, on the Routt National Forest, roughly 230 acres of lodgepole pine trees showed evidence of beetle-caused mortality in 1996. By 2006, that number had increased to 223,000 acres. On the Medicine Bow National Forest in southern Wyoming, aerial survey data from 1996 showed only 10 acres impacted by mountain pine beetles. By 2006, that number had increased to 75,000.

Data from ground surveys conducted between 2002 and 2006 were also summarized to augment the analysis of aerial survey data. In all cases, mountain pine beetle populations exceeded endemic levels (<0.5 infested trees per acre), and ranged from 2.8 to 89.4 newly infested trees per acre, with an average of 24.5 newly infested trees per acre (Lakewood Service Center Report, LSC-07-06). Data from both surveys clearly indicates that a mountain pine beetle epidemic is underway on the Medicine-Bow Routt National Forests.

General Setting:
The analysis area for proposed hazard tree treatments is the Routt National Forest in northwest Colorado. Approximately 20% of the Routt National Forest is designated wilderness.

About 78% of the Forest is classified as forested. Most of the forested land is composed of spruce/fir, lodgepole pine and aspen. Most of the Forest (60%) is in a mature condition. The nonforested land makes up about 22% of the Forest. It includes grassy meadows, shrubs such as sagebrush and oakbrush, and rock/talus slopes.

Average annual precipitation totals anywhere from 9.7 inches east of the Continental Divide to 67.4 inches west of the Continental Divide. (LRMP) Most incident moisture arrives in winter as snow but some precipitation falls during spring and summer thunderstorms. **Table 1** represents a summary of the habitat structure stages by cover type.

Table 1. Habitat Structure Stages by Cover Type.

	Acres in Habitat Structure Stage									
Cover Type	**0**	**1**	**2**	**3a**	**3b**	**3c**	**4a**	**4b**	**4c**	**5**
Aspen	0	0	14.5	21,023	91,079	13,417	14,822	76,042	22,425	0
Blue Spruce	0	0	0	0	0	0	11	0	0	0
Cottonwood	0	0	0	0	0	0	46	8	0	0
Douglas-fir	0	0	0	252	1,615	202	268	1,966	490	0
Gambel oak	0	0	1,858	0	0	0	0	0	0	0
Limber pine	0	0	0	196	119	0	0	0	0	0
Lodgepole pine	0	0	1,890	19,113	122,993	18,932	5,988	177,043	44,611	0
Ponderosa pine	0	0	0	0	0	0	30	7	0	0
Spruce/fir	0	0	570	14,646	64,237	8,484	12,049	145,845	30,281	0
Juniper	0	0	0	53	117	0	0	0	0	0
Other	0	0	0	35	112	0	0	0	0	0

Total Forested (914,771)	**0**	**0**	**4,333**	**57,318**	**280,153**	**41,035**	**33,214**	**400,911**	**97,807**	**0**
HSS as % of Routt Total Forested	**0%**	**0%**	**.473%**	**6.2%**	**30.6%**	**4.4%**	**3.6%**	**43.8%**	**10.6%**	**0%**
Total Non-forested (342,238)	**15,195**	**327,042**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
HSS as %Routt for Non-Forested	**1.6**	**96**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total	**15,195**	**327,042**	**4,333**	**57,318**	**280,153**	**41,035**	**33,214**	**400,911**	**97,807**	**0**
HSS as % of Total (1,257009.00)	**1.2**	**26**	**.034**	**4.6**	**22.2**	**3.2**	**26.4**	**32.**	**7.8**	**0**

0 –non-vegetated, 1-grass-forb, 2-shrub-seedling, 3a-low density sapling-pole, 3b medium density sapling-pole, 3c high density sapling-pole, 4a-low density mature, 4b-medium density mature, 4c high density mature, 5-old forest.

Plant Cover Type Summary

Plant cover types (current vegetation communities) that are expected to be present in the analysis area include lodgepole pine forests, Engelmann spruce (*Picea engelmannii*)/subalpine fir (*Abies lasiocarpa*) forests, quaking aspen (*Populus tremuloides*) groves and woodlands, open parklands and riparian areas (including seeps, fens, and carrs). On some lower-elevation south and west-facing slopes, Douglas-fir (*Pseudotsuga menziesii*) dominates in limited areas that have shallow soil or are rocky. Generally, forests below 9800 feet elevation are dominated by lodgepole pine while forests above 9800 feet are wetter and support mainly Engelmann spruce and subalpine fir. These plant communities are segregated along gradients of elevation, aspect, soils and topography and are directly affected by vital plant growth determinants such as temperature, effective precipitation and hydrologic regime.

Plant Cover Types

1. ***Medium and large-sized Lodgepole Cover Types***

   Lodgepole pine is the prevalent tree within this cover type; sometimes it is the only tree found in a local area. Lodgepole pines grow at lower elevations on warm to cold sites that are dry to moderately dry. Those stands having a 5 to 8.9 inch average girth at breast height are categorized as medium-sized whereas large-sized lodgepole stands have trees that average 9 to 15.9 inches in diameter at breast height (dbh). Although there are very large (16+ inch dbh) lodgepole pine individuals scattered within this cover type, there are limited, if any stands, in the action areas that have an average dbh that meets the minimum diameter for very large trees.

   Lodgepole pines usually comprise 80 percent or more of the basal area in areas of this cover type. Other conifers present in lodgepole stands include subalpine fir, Engelmann spruce and Douglas-fir. Where firs and spruces occur in lodgepole stands, they are seldom members of the (dominant or codominant) overstory. On

the other hand, Douglas-firs growing among lodgepole pines are usually the largest trees in the stand and the Douglas-fir crowns typically extend above the overstory, occupying the super-dominant canopy position.

Most medium or large-sized-tree lodgepole stands in the analysis area are even-aged, mature and are at the mid-seral stage of forest development. With few exceptions, lodgepole stands within proposed activity areas have a single-story canopy. Individual boles are separated somewhat from neighboring stems; only infrequently are there couplet or triplet sets of stems growing closely together. Stem diameters among most dominant and codominant trees frequently vary within a relatively narrow range of 2 to 5 inches. It is suspected that in nearly all stands, there are occasional wolf trees that are larger and occupy substantially more growing space than neighboring trees of similar age. Mature lodgepole stands with 2 distinct age-classes and 2 canopy layers are rarely present. However, where 2-story stands exist in the analysis area they are, almost without exception, the result of past logging.

Very rarely, remnant old-growth pines (trees 150 years old or older with characteristics as described in Mehl 1992) endure locally as individuals or in small groups. These old trees persist in current forest stands because they survived the last stand replacement (disturbance) event. However, old age pine trees are few in number in activity areas generally and their distribution is widely dispersed and irregular within lodgepole pine stands.

Most stands in this cover type had a natural genesis following the last stand-replacement disturbance (a forest fire preceded, perhaps, by a MPB outbreak). Most lodgepole pine stands present today are the result of natural succession, where trees regenerated from seed and stem density was not manipulated by people, at least until stands matured adequately for trees to reach a commercially valuable size. There are numerous areas of medium-sized trees (40 to 55 years old) that regenerated following clearcut harvesting in the middle part of the last century.
Although most medium and large-sized tree stands in the analysis area did have a natural origin, the majority of both natural and human-created lodgepole stands have been manipulated in the recent past through tree cutting. Thins or other partial cut treatments have typically been completed during the last 50 years in many stands adjacent to roads. Nonetheless, these stands are not much different from adjacent un-thinned lodgepole stands except, perhaps, there are fewer multiple-topped trees and the average trunk diameter is larger in cut stands.

In most cases, stands with a somewhat open canopy are the result of previous tree cutting. In nearly all previously thinned stands, the overhead tree canopy is not as highly interlaced as the tree canopy found in natural stands. In contrast to partially cut stands, un-manipulated natural stands are quite crowded with mature lodgepole and have a higher tree density. In these dense stands, small trees,

shrubs and other forest floor vegetation is usually depauperate beneath the dominant canopy.

Where stands were previously cut, and there is sufficient light reaching beneath the dominant canopy, lodgepole pine seedlings and saplings can be moderately abundant in the understory. Aspens are the next most common understory trees growing in these stands. Subalpine firs, and to a lesser extent Engelmann spruces, can be common in some stands but they are typically not abundant within many mature lodgepole stands in the action area. Neither of these species generally occupies a dominant or codominant position in the upper canopy.

Understory plants can be common too, if not abundant, in stands with an open canopy. Herbaceous plants commonly found in most analysis area pine stands include various grasses, sedges (*Carex* spp.) and forbs (herbs other than grasses, grass-likes, and ferns). Common graminoids include bluegrass (*Poa* spp.), mountain brome (*Bromus marginatus*), elk sedge (*Carex geyeri*) and Ross sedge (*C. rossii*). Prevalent forbs include lupine (*Lupinus argenteus*), strawberry (*Fragaria* spp.), pussytoes (*Antennaria rosea, A.* spp.), wintergreen (*Pyrola chlorantha*), heartleaf arnica (*Arnica cordifolia*), hawkweed (*Hieracium* spp.) and Parry's golden-weed (*Oreochrysum parryi*).

Woody plants are common in many stands as well. The most ubiquitous shrub occurring on cold and moderately dry sites is grouse whortleberry (*Vaccinium scoparium*). On warmer and drier sites, the following shrubs occur variably but commonly, depending on openness of the tree canopy and other factors: common juniper (*Juniperus communis*), kinnikinnick (*Arctostaphylos uva-ursi*), creeping Oregon grape (*Berberis repens*), mountain boxwood (*Pachistima myrsinites*) and russet buffaloberry (*Sheperdia canadensis*).

Large-sized snags (*i.e.*, snags with diameters larger than 9 inches dbh) are typically infrequent but are an increasingly common feature of many large-sized lodgepole pine stands in the analysis area. This growing number of snags is directly attributable to the current outbreak of Mountain Pine Beetle (MPB). Because nearly all existing large snags are trees that died only recently (within the last 4 years), they are labeled "hard (*i.e.*, the heartwood and sapwood is sound with little decay or deterioration evident)" snags. In contrast, large standing-dead trees in an advanced state of decomposition, usually described as "soft (rotten)" snags, are uncommon enough in this cover type as to be considered rare.

The explanation for the general lack of hard and soft snags in natural stands is related to the mid-seral development, relative vigor and middle age of lodgepole pine in this cover type. Until now, through what is termed by Oliver and Larson (1996) as the stand initiation and stem exclusion phases of stand development, there simply has not been sufficient time, or loss of tree vigor, for mortality agents (insects, disease, wind, *etc.*) to act upon and kill dominant and codominant trees.

Of course, without standing-tree mortality (hard snags) in the overstory, there is no current source for creation of large soft snags.

With the expected increases in large tree mortality occurring (as MPB kills more and more overstory pines), hard snags, soft snags and coarse woody debris quantities are expected to increase considerably. If fire or human intervention does not change the trajectory of lodgepole stands toward increased losses of overstory trees, the beetle outbreak could be seen as the nexus for the onset of the next phase in mature lodgepole pine succession: the understory reinitiation stage of stand development (Oliver and Larson 1996).

Dwarf mistletoe (*Arceuthobium americanum*) is prevalent in many mature lodgepole stands within the analysis area. Mistletoe control efforts have been an ongoing management activity, scattered across the analysis area, for many years. Some stem decays have been identified, during stand examinations, but the extent is quite limited.

Timber harvesting is the primary extractive use that occurs in mature lodgepole pine stands. Logging mature or old age trees has been ongoing within this cover type for many years.

2. ***Seedling and Small-sized Lodgepole Pine Cover Types***

Stands in this cover type (within the analysis area) are mostly plantations that developed following clearcut harvesting. A few young stands have regenerated following fire. For the most part these stands are relatively uniform, human-created forests of even-aged trees. Lodgepole pine predominates and typically composes more than 80 percent of all trees growing on a site. Other tree species scattered amongst the lodgepole are spruce, subalpine fir and aspen. Seedlings are less than 1 inch dbh and small-sized trees of this cover type are 1 to 4.9 inches dbh and 10 to 25 feet tall. In many plantations, large or very large live trees or snags are seldom present.

In thinned plantations, understory vegetation is responding to the more open tree canopy. Elk sedge, shrubs and grasses, as described for the medium and large-size lodgepole pine cover type, are growing in these stands. In plantations where no thin has yet taken place, crowns of interior trees often persist to the ground but stem densities are generally less than 1000 trees per acre.

3. ***Quaking Aspen Cover Type***

Individual aspen trees, aspen groves or both can be expected to be scattered among and within conifer forests. Where moisture and soil productivity are good, groves of tall, straight white-barked trees develop. Where quaking aspen groves are located within or next to lodgepole stands, the aspens are typically similar in diameter and height to the conifers surrounding them. However, some aspen patches (often associated with sagebrush areas) consist of stems that are clearly subordinate in size to neighboring conifer forests. On rocky slopes, hot aspects or

on poor soil, aspens form scrubby thickets and large aspen stems may be few or even absent. Aspens also occur in stringers along the banks of streams and in regenerating forest areas.

In groves of either large or small-sized aspens, conifers have often established themselves in the aspen understory and, many times, there are lodgepole pines overtopping the aspen. This is a visible indication of succession from aspen toward conifer dominance. Ingrowth of conifers into an aspen-dominated stand is commonly termed "conifer encroachment" and is a slow but inexorable vegetative progression that can ultimately result in supplanting of aspens by lodgepole altogether.

Understory vegetation in aspen stands is typically richer and more diverse than in neighboring conifer stands. Common herbaceous understory plants in the larger aspen stands include American vetch (*Vicia americana*), aspen peavine (*Lathyrus leucanthus*), Oregon fleabane/aspen daisy (*Erigeron speciosus*), yarrow (*Achillea millefolium*), Porter loveage (*Ligusticum porteri*), blue wildrye (*Elymus glaucus*), brome (*Bromus* spp.), Colorado columbine (*Aquilegia coerulea*), Fendler meadow-rue (*Thalictrum fendleri*), Richardson geranium (*Geranium richardsonii*) and strawberry.

4. Spruce/fir Cover Type

The spruce/fir cover type occurs on mesic sites at higher elevations and at lower elevations on northerly aspects or other sites of greater moisture retention. Where aspect or riparian moisture creates a mesic to wet environment, spruce can comprise the majority of basal area in the forest while subalpine fir, lodgepole pine and aspen may make up less than 50 percent of remaining trees. Conversely, where less moisture is retained on upland slopes due to aspect or soil porosity, lodgepole pine may compose upwards of 50 percent of the trees in these stands and spruce may be a minor component. In spruce/fir stands generally, increased variety of tree species and the typically longer subsistence of these stands provides for greater structural complexity than is found in the lodgepole cover type.

Spruce and subalpine fir regeneration is often abundant in the understory. Aspen groves are occasionally encountered in these stands. Grouse whortleberry is a ubiquitous shrub in the understory. Other prevalent shrubs or sub-shrubs include russet buffaloberry, mountain boxwood (*Pachistima myrsinites*) and prince's pine/pipsissewa (*Chimaphila umbellata*). Common forbs include heartleaf arnica, wintergreen, twinflower (*Linnaea borealis*), sweetroot (*Osmorhiza* ssp.), arrowleaf groundsel (*Senicio triangularus*) and bluejoint reedgrass (*Calamagrostis canadensis*).

Timber harvesting is the primary extractive use that occurs in mature spruce/fir stands. Logging mature or old age trees and regeneration of new forests has been ongoing within this cover type for many years.

5. ***Riparian Bottomlands Cover Type (Willow Carrs, Seeps, Springs and Fens)***
Generally diverse plant communities occur along streams and in or near seeps, springs, fens and carrs in the analysis area. Several environmental factors contribute to the patchy, highly variable plant assemblages found adjacent to these wet areas: duration of soil saturation, soil depth and texture, frequency of flooding, depth to the water table, soil oxygen availability, duration of snow cover, growing season length and temperature, animal browsing, and ice damage in the spring (Knight 1994). Terrain features, such as valley width and orientation, drainage basin area, stream gradient and sinuosity in turn influence the importance and primacy of these environmental factors.

Tall willow (*Salix* spp.) plant communities occur along numerous perennial streams forming a riparian greenbelt separate from mesic upland forests or sagebrush parks. Here, centuries of beaver activity have created relatively flat, stair-stepped mountain streams in what might have been a steep-sloping valley. The most frequent willows occurring in the tall willow carrs are planeleaf willow (*Salix planifolia*), Drummond willow (*Salix drummondiana*) and Geyer willow (*Salix geyeriana*). Other willows that are present but less abundant include Booth willow (*Salix boothii*), mountain willow (*Salix monticola*) and Wolf's willow (*Salix wolfii*). Occasionally, thinleaf (or mountain) alder (*Alnus incana*) is encountered.

Sedge/forb-dominated openings are commonly interspersed with riparian willow areas. Frequently encountered sedges associated with streamside areas and seeps/springs/fens are beaked sedge (*Carex utriculata*) and water sedge (*C. aquatilis*). Other sedges present include bighead sedge (*C. pachystachya*), alpine nerve sedge (*Carex nuerophora*), Nebraska sedge (*C. nebrascensis*), smallwing sedge (*C. microptera*) and slender-beaked sedge (*C. arthrostachya*). Rush species found here include longstyle rush (*Juncus longistylis*), swordleaf rush (*Juncus ensifolius*), Colorado rush (*Juncus confusus*) and small-flowered woodrush (*Luzula parviflora*). Other species observed are panicled bulrush (*Scirpus microcarpus*) and burr reed (*Spraganium emersum*).

Wet meadows and short willow shrublands support other plants. Lush forbs and grasses frequently encountered here include arrowleaf groundsel, gentian family members (*Gentianella* spp., *Pneumonanthe parryi* and *Swertia perennis*), slender hairgrass (*Deschampsia caespitosa*) and bluejoint reedgrass. Bog birch (*Betula nana*) grows in scattered streamside locations in the analysis area, along upland forest edges where soils are seasonally saturated, usually forming complex, low stature, open shrubland mosaics.

6. ***Open Parkland/Sagebrush Steppe Cover Type***
The non-forested park areas of the analysis area include sagebrush and grass dominated communities. Compared to grasslands, the distinguishing features of sagebrush ecosystems are the presence of a conspicuous shrub and a larger

proportion of the annual precipitation occurring during winter. In addition, a prominent characteristic of these mountain parks is deep, well-drained soils.

Within parks of the analysis area, silver sagebrush (*A. cana* subsp. *viscidula*) and mountain big sagebrush (*Artemisia tridentata* subsp. *vaseyana*) are the predominant shrubs. Frequently, these 2 sagebrush varieties grow side by side. Other associated shrubs include fringed sagebrush (*A. frigida*), shrubby cinquefoil (*Dasiphora floribunda*) and common rabbitbrush (*Chrysothamnus nauseosus*). Silver sagebrush is normally less than 0.5 meter tall and typically occupies low-lying areas, swales or ephemeral draws. Mountain big sagebrush can attain a height of about 1 meter tall and thrives at higher elevations along forest edges where upland sites provide cooler conditions. Some of the common grass species associated with the sagebrush cover type are Idaho fescue (*Festuca idahoensis*), Thurber fescue, western wheatgrass (*Pascopyron smithii*), prairie junegrass (*Koleria cristata*), needle grass (*Stipa* spp.) and Sandberg bluegrass (*Poa sandbergii*).

Cover Types as Bird and Mammal Habitat

Because of the minimum of six cover types encompassed by the analysis area, and the mixture and juxtaposition of these cover types across the landscape, habitat diversity in the analysis area is high for both birds and mammals. Consequently, wildlife species richness and diversity is high because of the broad assortment of habitats made available by the mosaic of intermingling cover types. A large number of bird and mammal species inhabit the analysis area year around and many more migrate to the area seasonally to breed and raise young.

Other General Setting:

Vegetation Disturbance

In the Routt analysis area ecosystem, disturbance is the critical factor in maintaining the natural diversity of species. Without disturbance, subalpine fir and Engelmann spruce would eventually replace disturbance dependent species such as lodgepole pine and aspen. The presence of these species at the middle and lower elevations of the analysis area is reflective of disturbance in the form of fire. Natural and human caused wildfires have been a major factor in forming the forests we see today in this ecosystem. It is known that fires burned large portions of this range, playing an important role in the appearance of the landscape, and maintaining a mix of tree species in various successional stages. Stand origin dates, estimated from tree growth ring data, provide a map of where and approximately when stand replacing/regenerating fires occurred.
A trend that has been found across the Forest, due to the high amount of fires that occurred around 1900, there is a relatively high amount of stands that are between 80 to 120 years old within the AA.

Forest Insects and Disease

While bark beetles are always present in low numbers, recent years have seen a dramatic increase in bark beetle activity and conifer tree mortality on the Medicine Bow-Routt

National Forests. The current mountain pine beetle infestations and their impact on lodgepole pine forests have likely been influenced by a number of factors, including: 1) an abundance of older, dense, large diameter lodgepole pine stands; 2) prolonged drought; 3) earlier melting of the smaller, drought-influenced snowpacks, resulting in extended and more severe drought conditions; 4) higher temperatures, allowing for an expansion of the one-year mountain pine beetle lifecycle into areas of lodgepole pine forests at higher elevations (>9,500 feet elevation); and 5) greater survival of mountain pine beetle broods in the high elevation lodgepole pine forests. Unless a period of prolonged and severe low temperatures (<-30° F) occurs during late fall-winter-early spring months, the beetle epidemic is likely to continue and increase.

Aerial surveys conducted annually for the Medicine Bow-Routt National Forests show that losses of lodgepole pine to mountain pine beetles have increased significantly in extent and number over the past 11 years. For example, on the Routt National Forest, roughly 230 acres of lodgepole pine trees showed evidence of beetle-caused mortality in 1996. By 2006, that number had increased to 223,000 acres. On the Medicine Bow National Forest in southern Wyoming, aerial survey data from 1996 showed only 10 acres impacted by mountain pine beetles. By 2006, that number had increased to 75,000.

Data from ground surveys conducted between 2002 and 2006 were also summarized to augment the analysis of aerial survey data. In all cases, mountain pine beetle populations exceeded endemic levels (<0.5 infested trees per acre), and ranged from 2.8 to 89.4 newly infested trees per acre, with an average of 24.5 newly infested trees per acre (Lakewood Service Center Report, LSC-07-06). Data from both surveys clearly indicates that a mountain pine beetle epidemic is underway on the Medicine-Bow Routt National Forests.

The extent and numbers of beetle-caused mortality can pose significant threats to public safety for a variety of reasons. For example, there is an increased risk: 1) for persons or property being struck by falling trees; 2) of wildland fire from lightening striking dead trees vs. live green trees; 3) for more catastrophic fire events due to increased fuel loads; and 4) of trees falling and blocking roadways, thus preventing both emergency and non-emergency ingress and egress. All of these factors can be mitigated by the removal of dead and dying trees along roadways and trails and in areas that receive concentrated public use.

Past Timber Harvest

There has been harvest in some portions of the Routt National Forest in the past. Vegetation changes caused by these actions and the subsequent regeneration are reflected in Table 1. Habitat Structure Stages by Cover Type. Routt-wide projects, and acres, that have been planned, but have not yet been treated are not reflected in Table 1. Future habitat changes caused by these projects are included in the cumulative effects analysis for the appropriate sensitive species.

Livestock Grazing

Grazing of domestic livestock is the primary extractive use that occurs Routt, NF-wide. Livestock are grazed in park and sagebrush areas for only a portion of the year, typically

from early summer through early fall. Use of these types of areas for feeding domestic livestock has likely taken place across the Forest for more than a century.
There are several allotments or portions of allotments in the analysis used for domestic sheep or cattle grazing. USDA (1995) included a series of Biological Evaluations that analyzed the effects of livestock grazing to endangered, threatened, proposed, and sensitive species across the Rocky Mountain Region. These Regional BE's addressed many of the species that will be included in this analysis. These BEs were reviewed and were verified to be appropriate and accurate for this analysis area. USDA (1995) determined that livestock grazing in the Rocky Mountain Region has no impact to Northern goshawk, boreal owl, flammulated owl, black-backed woodpecker, American three-toed woodpecker, olive-sided flycatcher, pygmy shrew, American marten, and wolverine. Also, the programmatic BE for the effects of livestock grazing on the Peregrine falcon and its associated habitat within the Rocky Mountain Region (1995b) determined that livestock grazing had no effect on the Peregrine falcon.

Recreation
Several multiple use trails (to include motorized and non-motorized) can be found within the analysis area. Used mostly for hiking in the summertime, the higher elevations contain portions of the trail systems—including the Continental Divide National Scenic Trail (CDNST), which access the Mt. Zirkel Wilderness area. There are nine million acres of National Forest System lands on the Routt NF. All Terrain Vehicle (ATV) use on existing travel ways is high. Area National Forest System Roads (NFSRs) are used by snowmobilers during the winter. Many of the major area Forest roads are groomed for snowmobiling. A non-motorized trail system is also groomed for cross country skiing and snow-shoeing. Parking lots and campgrounds provide parking for snowmobilers and skiers using the extensive area trail system. In addition to the numerous trail opportunities, the area contains a number of developed campgrounds and picnic areas. Other major recreational uses in the area include big game hunting, dispersed camping, ATV/ORV use, driving for pleasure, and personal use firewood cutting.
Although mining activities could be considered insignificant at this time, Routt-wide activity may increase in the future. There is possibly some infrequent, personal use panning by the public but this is not sufficient to disturb individual wildlife species or their habitat.

Roads
The Travel Management roads analysis for the Routt revealed that there are a number of roads within the project area requiring maintenance or closure and rehabilitation to reduce soil erosion and sediment entering area creeks. In addition, high open road density could potentially be degrading wildlife security areas and habitat. The popularity of ATV use in the vicinity has led to the creation of a number of user created trails throughout the area—including ones that have encroached into areas that are currently off limits to motorized use.

Management Indicator Species (MIS)

The National Forest Management Act directs National Forests to identify Management Indicator Species (MIS). The Forest Service Manual defines Management Indicator Species (MIS) as "…plant and animal species, communities, or special habitats selected for emphasis in planning, and which are monitored during forest plan implementation in order to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent" (United States Department of Agriculture [USDA]-Forest Service 1991).

MIS are chosen as species representative of certain habitat conditions important to a variety of other species. MIS are generally presumed to be sensitive to habitat changes. By monitoring and assessing populations of MIS, managers can determine if management actions are affecting species populations. According to the *Routt National Forest Land and Resource Management Pl*an amendment #4 (USDA Forest Service, 2007), MIS for the Routt National Forest (RNF) include the 6 wildlife species found in Table 2.

As such, in selection as an MIS for the 2007 Revision, no concern existed for the viability of these species or local populations and viability was neither a rationale nor motivation for their inclusion on the Forest MIS list (Hickey, J. pers. comm.).

Summary

The proposed action and no action will provide habitat for MIS. Proposed actions must follow Forest Plan (2007) standards and guidelines for water and aquatics, biological diversity, wildlife, and threatened, endangered and sensitive species (see USDA 2007). These requirements should provide water, foraging habitat, roosting habitat, prey animals, and breeding/nesting habitat sufficient to support populations of MIS. Thus, these requirements will support the Forest Plan objective for MIS of "…maintain or improve habitat for Management Indicator Species (MIS) across the forest in the long-term".

Table 2 – Routt National Forest Revised MIS List

Routt National Forest Revised MIS List	
Common Name	**Scientific name**
Golden-crowned kinglet	*Regulus satrapa*
Northern goshawk	*Accipiter gentilis*
Vesper sparrow	*Pooecetes gramineus*
Wilson's warbler	*Wilsonia pusilla*
Colorado River cutthroat trout	*Oncorhynchus clarki pleuriticus*
Brook trout	*Salvelinus fontinalis*

At the project level, management indicators are selected that best represent the issues, concerns and opportunities of the project. MIS were reviewed to determine which are present, have habitat in the project area, and to identify those likely to be affected by the implementation of the decision. Table 3 outlines RNF MIS, their presence in the analysis

area, and anticipated effects due to implementation of an action alternative. This report covers only the terrestrial species.

The Hazard Tree and Fuel Reduction Project Contains 2 alternatives: Alternative 1, the 'No-Action'; Alternative 2, the Proposed Action.

Alternative 1, the 'No- Action' alternative is NEPA required alternative to compare the effects of 'Action' alternatives to. Therefore no management actions are proposed with the 'No-action Alternative.

Alternative 2-Under the Modified Proposed Action, standing dead and dying trees that are within 1 ½ tree heights (up to 150 feet) from the centerline of: 1) state and county roads that cross the Forest (Routt National Forest wide); and 2) Forest Service system roads open to public travel (Maintenance levels 2 – 5) would be felled and/or removed. Standing dead and dying trees in and adjacent to Forest Service campgrounds, administrative sites, and Forest Service trailheads would also be felled and/or removed; standing dead and dying trees would be felled, but not removed, along Forest Service trails. Healthy, stable, live trees and dead and dying trees leaning away from the roads and trails and other aforementioned sites would be retained unless the dead trees pose a safety hazard in the felling/removal operation.

The majority of the treatments would impact lodgepole pine trees, although small amounts of Engelmann spruce, sub-alpine fir, and aspen could also be felled and/or removed. Depending on the severity of the infestation and the resultant mortality, harvest treatments could include clearcutting, patch clearcutting, overstory removal, thinning, and group selection. (*Refer to the LRMP, FEIS, Glossary for a definition of harvest treatments.)* In these situations, forest products would be removed (where feasible) or fuels would be treated on site. Fuel treatments could include chipping, lopping and scattering slash to an 18 or 24 inch depth, roller chopping, machine trampling, and/or broadcast burning. Hand piling, pile burning or mulching may occur in select units to mitigate fuels or visual concerns.

Small personal use sales, timber sales, free personal use and administrative use permits, Forest Service crews, service contracts, and Stewardship contracts are all examples of instruments that could be used to implement the hazard tree removal project.

Design criteria would be applied to protect sensitive areas, such as streamside management zones. Priority for scheduling treatment would be determined by the severity of bark beetle infestation, mortality of trees, and the severity of safety hazard posed.

For a full description of the alternatives as well as project design criteria, mitigation and monitoring requirements, please refer to the Environmental Assessment prepared for this project.

The following table (**Table 3.**) represents a summary of anticipated effects from implementation of the action alternative to the four species analyzed (two comprehensively analyzed).

Common Name of MIS	Management Issue or Habitat Assemblage	Species Present/ Habitat in Analysis Area	Species Selected for More Detailed Analysis	Management Issue or Habitat Assemblage Summary of Anticipated Effects From Implementation of an 'Action Alternative' to MIS, and Rational for Detailed Analysis/or Not
Golden-crowned Kinglet	Spruce-fir timber management	Yes	Yes	Implementation of an action alternative will impact minimal amount of the spruce-fir forests and thus habitat for this species. The amount of impact anticipated could reduce some habitat in the short and mid term, but statistically significant changes to forest-wide population trend as a result of implementation of an action alternative are not anticipated.
Northern goshawk	Lodgepole pine timber management	Yes	Yes	Implementation of an action alternative will affect habitats used by goshawks. Project specific design criteria are established to find, locate and protect nest sites and nesting birds from disturbance and impacts to habitat within nesting stands. This project 'may affect individual northern goshawks, but is not likely to cause a trend towards federal listing or a loss of population viability on the Routt National Forest.'
Vesper sparrow	Rangeland residual forage	Yes	No	Action alternatives do not propose actions that would affect the vesper sparrow habitat therefore this species is not anticipated to be affected by implementation of an action alternative.
Wilson's warbler	Herbivory in riparian areas	Yes	No	The action alternatives have watershed design criteria that are likely to eliminate any impacts to habitat that may be used by the Wilson's warbler. Therefore the implementation of an action alternative is not anticipated to affect this species.

MIS for this analysis area were evaluated according to their habitat available in the analysis area, the issue/habitat assemblage those species represented as MIS, the relevance of the issue/habitat assemblage to the project, and whether the project has negligible effects to the MIS or its habitat. Those MIS that have habitat in the analysis area, represent an issue/habitat assemblage that can be affected by the project, and might have more than a negligible effect caused by the project include golden-crowned kinglet, and the northern goshawk. These two species will be analyzed further for comprehensive population analysis and project affects.

Note: There is Forestwide monitoring data available in the Forest's stopgap report for all species.

All Alternatives - Impacts common for all species
It is expected that the spread of pine beetles will cause changes to some existing habitat. Generally, pine beetles on the Forest have been causing tree mortality that results in the loss of most or all pine trees >6 inches dbh in affected areas. The final extent of beetle-killed lodgepole across the Forest over time cannot be predicted but it is known that mature forest habitat has been rapidly changed will continue to be rapidly changed until the beetle outbreak returns to endemic levels.

Studies from Oregon found that lodgepole pine killed by MPB began falling three years after death in thinned stands and five years after death in unthinned stands (Lewis, K.J. and I.D. Hartley. 2006, Mitchell and Preisler 1998). These and other changes could create an immediate substantial (1-10 years) loss of mature and older aged forest important to many Region 2 such as the golden-crowned kinglet, goshawk, and many other species. These species are addressed individually in the following pages.

Over time, perhaps 2 decades, these stands will have a high density of large snags and later coarse woody debris from beetle-killed trees. This is not a common characteristic across the Forest and could provide unique habitat opportunities for cavity-nesting, denning, many small mammals, and several furbearing wildlife.

Generally, there is a large increase in understory production by existing grasses, forbs, and shrubs but little change in understory plant diversity where pine beetles have killed a large portion of lodgepole within a stand (Stone and Wolfe 1996). Time since death of beetle-killed trees is an important factor determining usefulness of these trees for wildlife (Chan-McCleod 2006): wildlife species that require mature forest cover are less affected in 3 to 5 years; as the stand continues to break up over time it becomes less favorable to mature forest species; wildlife species that thrive in open, edge, or coarse woody debris habitat benefit in the mid and long term; and salvage harvesting of beetle-killed stands might rejuvenate stands more quickly.

As pine beetles create more stands of dead and dying lodgepole pine, there is also an increased risk for more catastrophic fire events due to increased fuel loads. The extent or frequency of future catastrophic fires is unknown but it is known that these events would rapidly reduce the amount of forested habitat for years. Catastrophic fires after a beetle epidemic would typically result in a more continuous fire affected habitat across the landscape, cause higher live tree loss, greater understory vegetation loss, reduced coarse woody debris, and longer recovery time for revegetation. These characteristics delay or reduce habitat quantity and quality for Forest wildlife compared to less catastrophic fires.

The habitat of particular interest to this project is beetle-killed or dying lodgepole along existing open roads and surrounding administrative sites. Abundant research indicates that habitat quality for many of the Forest's wildlife is already reduced along roads. Effects are usually identified as direct loss of habitat, changing landscape pattern of habitat, increased predation, parasitism, reduced fitness from disturbance, collision with vehicles, harassment or other disturbance. Following is a summary of some research on the effects of roads to wildlife that is applicable to this analysis.

Road use can cause disturbance to wildlife and there is a potential for wildlife/vehicle collisions (USDA 2003c, Saratoga). Vehicle collisions with wildlife are uncommon on the Forest, however.

Tinker et al. (1998) found roads were a more significant agent of change to the landscape than clearcuts in the Bighorn National Forest by decreasing patch size, increasing patch density, increasing edge, and simplifying patch shape. The effect of road edges may

extend more than 50 meters into the adjacent forest. Edges created by roads and clearcuts are different from edges created by natural events such as fire because road created edges are abrupt.

Reed et al. (1996a) studied the Tie Camp area immediately west of the Blackhall/McAnulty analysis area. They found that roads added to forest fragmentation more than clearcuts by creating smaller patches, more patches, and converting interior habitat to edge habitat. Roads increased the number of patches by 179% and decreased patch size by 65% since 1950. Roads increased the distance between patches of interior habitat. Whereas natural and clearcut patches become progressively less defined, road edges exist long term and are more frequently disturbed.

Hutto (1995) found that brown creepers and golden-crowned kinglets were more than twice as likely to occur more than 100m from roads than adjacent to roads.

Ortega and Capen (2002) found 4 of 18 forest interior bird species had lower relative abundance or territory density adjacent to unpaved roads while 4 of 6 edge nesters had higher relative abundance near unpaved roads. Their results suggested that narrow openings within forested landscapes may affect habitat use.

Wiedenmann (1991) found that singing behavior by breeding birds in the Brush Creek-Hayden District (Saratoga, WY.) could be affected by human intrusion as infrequent as twice a week. Of course, Forest access is greatly influenced by the extent of the road network.

Proposed Action - Effects common to all species
Proposed actions can temporarily eliminate habitat for a particular species. Individuals of that specie are not expected to use that habitat until sufficient vegetation regeneration occurs. Proposed actions can also reduce the quality of habitat for a particular species. In these cases, individuals are expected to require larger territories or home ranges in order to meet all their survival needs. As a result, the density of individuals will decline in that reduced quality habitat.

Additionally, noise and other activities of the proposed actions can disturb some individuals of species for a short time in untreated areas that are adjacent to hazard tree removal units. Individuals of species could leave the immediate area during the brief period of harvest but can return to the adjacent untreated areas immediately after harvest is completed. Habitat, prey density, and prey habitat will not be changed in the untreated adjacent areas. Individual species or their prey could forage in nearby undisturbed areas while harvest occurs. The temporary disturbance in adjacent untreated areas caused by this project is not expected to cause decreased reproductive success, decreased survival, or increased territory size for any individual species.

There has been harvest in some portions of the Routt National Forest in the past. Vegetation changes caused by these actions and the subsequent regeneration are reflected in the existing condition (Table 1, Habitat Structure Stages).

Golden-Crowned Kinglet (*Regulus satrapa*)

The golden-crowned kinglet was selected as an MIS to represent issues associated with spruce-fir timber management. Golden-crowned kinglets are permanent residents on the Routt National Forest and use spruce/fir habitats within the area at all times of year. Refer to the Environmental Assessment for Management Indicator Species Forest Plan Amendment 04 and the associated Decision Notice for more information regarding this species selection as an MIS (USDA Forest Service, 2007).

Natural History — The golden-crowned kinglet is the smallest songbird in North America (Fisher 1997). It is a widespread and common species of northern and western coniferous forests. They occupy spruce/fir forests in most of the high country (Kingery 1998). Birds of the forest interior, golden-crowned kinglets use old-growth coniferous forests or stands with old-growth characteristics (Kingery 1998).

"Atlas data show a breeding season beginning 28 May with nest construction and ending in late August with fledgling activities. This range of dates conforms to a two-brood nesting pattern. Of the total breeding confirmations, 92% occurred during the second half of the breeding season. May and June access to the high country, restricted by lingering deep snow, probably caused this bias" (Kingery 1998). The golden-crowned kinglet breeds primarily in mature, dense spruce-fir forest, and rarely in limber pine and Douglas-fir forests. They regularly raise 2 broods per year in northern states with clutch sizes between 5 and 11 eggs. In winter, the species occurs in coniferous forests (especially Douglas-fir or ponderosa pine) but also in piñon-juniper woodlands, foothill and lowland riparian forests, planted conifers in parks, cemeteries, and residential areas in the lowlands. During migration, the golden-crowned kinglet occurs in most wooded habitats. Atlas data show a very limited breeding presence in Colorado blue spruce along foothill streams, lodgepole pine forests, Douglas-fir, and ponderosa pine (Kingery 1998).

Golden-crowned kinglets feed primarily on invertebrates. They will glean and capture prey in the canopy, with increased use of tree limbs and trunks in winter. In the northern part of its range, this species may be limited by severe winters. Up to 100-percent mortality has been estimated locally during severe storms. "Kinglets are the smallest passerine bird, with high energetic demands. Availability of roost sites such as tree cavities or squirrel nests are critical in the winter months. Habitat changes such as forest thinning, timber harvest and spruce die-off may reduce local populations. Breeding densities [are] also known to decline in burned and logged areas, habitats with open canopies, hardwood forests, and pure stands of lodgepole pine" (USDA Forest Service 2005).

Population Status, Trend and Abundance — The golden-crowned kinglet is not designated on any Federal, State, or USDA Forest Service species conservation lists. This species is widely distributed with breeding occurrences from southern Alaska to Newfoundland southward to central California, southern Utah, southeastern Arizona, southern New Mexico, northern Wisconsin, northern Ohio, New York and Tennessee, to the mountains of Mexico and western Guatemala. This kinglet has centers of abundance in the northwest and southeast United States with its highest density in the western part of the range and is among the most abundant bird species in studies in Oregon and

Washington (USDA Forest Service 2005). Nation-wide there appears to be some decline on the west coast (2.7 percent annual for 1966-1994) with a concomitant increase in the east (6.1 percent per year for the same period) (USDA Forest Service 2005).

In Region 2 (USDA Forest Service), the golden-crowned kinglet is widely distributed in coniferous forests and is a year round resident across most of the region (USDA Forest Service 2005). Atlas data show that Colorado golden-crowned kinglets, although never abundant, occur mostly west of the Continental Divide (Kingery 1998). Kinglet numbers vary from year to year, and in some localities they become exceedingly rare for an entire breeding season (Kingery 1998). Populations of kinglets probably experienced declines at the turn of the century because of intensive logging and mining activities (Kingery 1998). Even small clear cuts cause a significant drop in their numbers. Populations subsequently recovered with regeneration of dense forest due to fire suppression, changes in logging techniques, and, more recently, wilderness designations (Kingery 1998).

Skorkowsky (2003) conducted a Master's thesis study on "The Effects of Blowdown and Subsequent Salvage Logging on Forest Songbird Populations." This monitoring effort provided quantitative data for densities of songbirds inhabiting the spruce/fir cover types. The golden-crowned kinglet is one of these avian species. During the time surveys were conducted, between 1999 and 2001, golden-crowned kinglet densities were estimated to be 0.08 birds/ha (ha = hectare = 2.5 acres) in the blowdown areas (BLD), 0.03 birds/ha in the salvage areas (SAL), and 1.45 birds/ha in the mature spruce/fir (TSP) cover type. On the Routt National Forest, there are approximately 254,000 acres, or 101,600 hectares of mature spruce/fir (USDA Forest Service 1997). Based on densities of golden-crowned kinglets found in the spruce-fir cover type during the survey period, the population density of this species may be estimated at roughly 147,320 territorial pairs (or 294,640 total) occupying the Routt National Forest. Additionally, this research has further demonstrated the preferred habitat of the golden-crowned kinglet.

Abundance estimates were also obtained from data collected through the Colorado Breeding Bird Atlas (Kingery 1998). For golden-crowned kinglets, the Atlas estimates there to be on average 104,566 breeding pairs in Colorado (Kingery 1998). This number is different from the estimates found in Skorkowsky (2003) – likely due to their different methodologies. "The data demonstrate presence of a species, but do not necessarily denote absence. The block selection and uneven block coverage prevent an unequivocal statement that a species does not breed in a particular geographic area where Atlasers did not locate it" (Kingery 1998, p11-12). Hence, Kingery's (1998) estimates are admittedly under-estimates and allow for the possibility of higher numbers, such as those detected by Skorkowsky's (2003) more localized data. These kinglets were observed in 188 of the 1745 priority blocks for a total of 11% of all breeding blocks surveyed in the state (Kingery 1998). Golden-crowned kinglets were detected within 51% (19 of 37) of blocks on the Routt National Forest (Kingery 1998). This estimate is from an 8-year long survey effort but is statistically a "first approximation" (Kingery 1998, p. 18 and p. 584), and ranks this bird as the 72nd most abundant in the State (from 264 confirmed breeding species).

Sauer et al. (2004) have analyzed bird count data gathered between 1966 and 2003 from breeding bird transects across North America. The results of their analyses are available at different geographic scales. For golden-crowned kinglets, count data have been

collected nearly every spring on each of 22 Breeding Bird Survey (BBS) routes in the Southern Rocky Mountains Region. Population trend derived from these data implies an annual decline in kinglet numbers (-2.33% per year) but the yearly counts of kinglets on these routes have been highly variable (Sauer et al. 2004). Consequently, using an alpha (α) of 0.1, available data for kinglets over this 37-year sampling period is sufficiently disparate that a statistical test is unable to discern whether the estimated trend is significantly different from 0 (i.e., a stable population). In other words, despite substantial golden-crowned kinglet data gathered on BBS routes in the Southern Rocky Mountains, the estimated decline in their numbers is not significant ($p = 0.47$ from Sauer et al. 2004). However, this lack of significance should not be interpreted to mean the trend is stable. Rather, the test for significance indicates data thus far collected on the 22 Southern Rocky Mountains BBS routes are inadequate to reject the null hypothesis that the real trend is different from 0. Similarly, no significant trends were detected at the State level (-2.7%/year, $p=0.38$).

Routt National Forest MIS Monitoring - The Routt National Forest has an established protocol for monitoring the golden-crowned kinglet as a Management Indicator Species. This protocol is based on point transect sampling and distance analysis. The protocol identifies an approach to evaluate the Forest trend to trend at the scale of the state of Colorado and evaluate if the rate of change between the two trends is significantly different (Skorkowsky and Dolan, 2005).

A preliminary analysis was conducted in 2005 (Lukacs, 2005). A more complete analysis will be completed in 2007, the 2007 analysis was not final at the time this report was prepared.

The 2005 report indicated that in Colorado GCKI were more abundant in spruce-fir habitat than other habitats (Table 4 and 5). Spruce-fir was not sampled in 2003. GCKI detections were low per year and very low in non-spruce-fir habitat. This limited detection probability to being estimated as constant across year and habitat. Estimated density in 2004 was particularly imprecise (Figure 1).

Table 4. Counts observed (n), number of transects surveyed (k), standard error of encounter rate (se (n/k)), detection probability (Pa), standard error of detection probability (se (Pa)), density estimates (D, birds per hectare) and standard error of density (se (D)) by year for Golden-crowned Kinglets in spruce-fir habitats in Colorado. Truncation distance is 50 m.

year	n	k	se(n/k)	P_a	se(P_a)	D	se(D)
1998	60	22	0.409	0.335	0.013	0.690	0.114
2001	22	21	0.284	0.335	0.013	0.265	0.084
2002	23	18	0.410	0.335	0.013	0.323	0.089
2004	20	28	1.920	0.335	0.013	0.181	0.893

Table 5. Counts observed (n), number of transects surveyed (k), standard error of encounter rate (se (n/k)), detection probability (Pa), standard error of detection probability (se (Pa)), density estimates (D, birds per hectare) and standard error of density (se (D)) by year for Golden-crowned Kinglets in non-spruce-fir habitats in Colorado. Truncation distance is 50 m.

year	n	k	se(n/k)	Pa	se(Pa)	D	se(D)
1998	4	54	0.036	0.335	0.013	0.032	0.017
2001	7	222	0.022	0.335	0.013	0.014	0.007
2002	11	262	0.013	0.335	0.013	0.018	0.007
2004	12	283	0.019	0.335	0.013	0.018	0.007

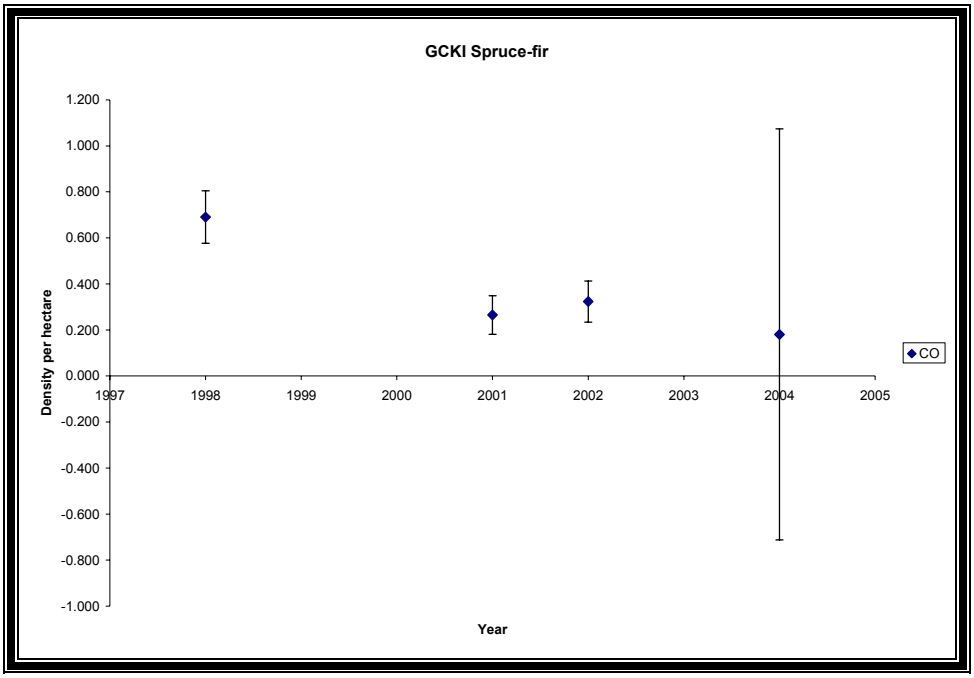
Table 6. Counts observed (*n*), number of transects surveyed (*k*), standard error of encounter rate (se (*n/k*)), detection probability (P_a), standard error of detection probability (se (P_a)), density estimates (*D*, birds per hectare) and standard error of density (se (*D*)) by year for Golden-crowned Kinglets in spruce-fir habitats on the Routt National Forest. Due to very low numbers of detections, density was not estimated. Truncation distance is 50 m.

year	*n*	*k*	se(*n/k*)	P_a	se(P_a)	*D*	se(*D*)
1998	0	1					
2001	1	1					
2002	0	1					
2004	0	1					

Table 7. Counts observed (*n*), number of transects surveyed (*k*), standard error of encounter rate (se (*n/k*)), detection probability (P_a), standard error of detection probability (se (P_a)), density estimates (*D*, birds per hectare) and standard error of density (se (*D*)) by year for Golden-crowned Kinglets in non-spruce-fir habitats on the Routt National Forest. Due to very low numbers of detections, density was not estimated. Truncation distance is 50 m.

year	*n*	*k*	se(*n/k*)	P_a	se(P_a)	*D*	se(*D*)
1998	0	3					
2001	0	8					
2002	3	8					
2004	1	13					

Figure 1. Golden-crowned kinglet density estimates in spruce-fir habitat in Colorado. Error bars represent one standard error of estimated density.



Raw data associated with the Forest songbird MIS monitoring program is included in the Rocky Mountain Bird Observatory data base. A query of the Rocky Mountain Bird Observatory's database for this species and the Routt National Forest provided the following information on observations of this species from monitoring transects located on the Routt National Forest.

Table 8: Golden-crowned kinglet – raw data counts for the Routt National Forest 1998-2007

Management Entity: USFS **Management Unit:** Routt NF
State: CO **County:** All
Habitat: All **Transect:** All
Year: **1998 - 2007** Species: Golden-crowned Kinglet
Total # species: 1 Total # birds counted: 158

Counts by Species

Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Total Year
Golden-crowned Kinglet	1	6	22	1	17	2	3	21	27	58	158
Total	1	6	22	1	17	2	3	21	27	58	158

Effort (# points surveyed)

Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Total Year
Total	75	195	213	180	210	135	197	560	621	608	2994

This species is documented to occur on the Routt NF and is highly likely to occur in the analysis area, and is expected as a resident species in the project areas, although sightings, or occupancy, may be happenstance as the referred habitat of this species is spruce-fir.

Existing habitat for golden-crowned kinglets across the Routt National Forest generally, conditions are well-suited to sustaining endemic populations of these birds. During the last 50 years, as conifer throughout the Routt National Forest matured, and trees have grown in diameter, golden-crowned kinglet populations have undoubtedly increased as numbers of suitable nest trees and food resources have multiplied. The availability of large trees (some of which are infested with heartrot that provides essential cavities for winter survival) and late-seral stands provide conditions favorable for sustaining fit golden-crowned kinglet breeding populations.

Conclusions — Collectively, then, available population and habitat information suggests golden-crowned kinglets on the Routt National Forest have a population trend that is currently stable, and likely was increasing until recently. Skorkowsky (2003) demonstrated potentially higher densities of golden-crowned kinglets on the Routt National Forest relative to the state as a whole. In addition, the golden-crowned kinglet is well distributed on the Forest and throughout all mature-forest areas in Colorado. Evidence from the Colorado Breeding Bird Atlas surveys across the State, suggests golden-crowned breeding pairs are not present in high densities and are somewhat sparsely scattered on the landscape (but are not scarce).

Golden-crowned kinglets are expected to remain fairly common on the Routt National Forest, though anticipated declines in mature spruce-fir associated with natural beetle infestations may contribute to a future decline. Even still, that decline is expected to remain within the natural range of variation because bark beetles have evolved with the spruce-fir ecosystem and declines associated with their activity should therefore remain within natural (or historic) levels. Maintenance of intact, mature spruce-fir forests should ensure that golden-crowned kinglets remain characteristic residents on the Routt National Forest.

Emerging infectious diseases could complicate efforts to predict future wildlife population trends. For instance, there have been recorded incidences of West Nile virus occurring in golden-crowned kinglets (CDC 2005). While it is unknown how this disease will impact Forest populations, the potential for adverse impacts influencing population trends on the Routt National Forest may exist.

Effects of the No Action (Alternative 1) to the Golden-Crowned Kinglet

Direct Effects and Indirect Effects

Natural fire regimes, endemic levels of insects and pathogens play significant ecological roles including tree mortality, defoliation, decay, and deformity. These processes provide some components of golden-crowned kinglet habitat. No action will result in positive and negative effects to golden-crowned kinglets. Natural tree mortality from beetles, disease or wildfire would create important roosting habitat but could also decrease the mature, closed canopy conifer forest used for nesting and foraging.

Where beetle-kill in lodgepole is complete and widespread, mature lodgepole forest will change to very little canopy cover and change to an earlier structural stage. These changes would be the result of extensive loss of large trees to beetles. There will be a corresponding increase in snags.

The spread of existing bark beetle endemic would increase snags used as winter roosting sites. These sites are critical for communal roosting to survive cold winter months. Time would be required for these to develop natural cavities or have cavities excavated by woodpeckers to become suitable as roosts. There will still be a high density of beetle-killed trees available as potential roosting sites in 25 years (see USDA 2003, p. D-80).

However, golden-crowned kinglet also requires mature, closed canopy forest for nesting and foraging. If beetles or other pathogens killed whole stands of trees as predicted under the no action scenario, then much golden-crowned kinglet habitat could be lost. If pathogens killed individual trees, then golden-crowned kinglet habitat will be enhanced because most canopy cover will remain for nesting and foraging and there will be an increase in snags for roosting. Nicholoff (2003) and USDA (2004) indicated that golden-crowned kinglet were sensitive to a variety of canopy reducing activities including partial harvest, thinning, and fires. It would follow that they are also sensitive to beetle outbreaks that reduce canopy cover. Some understory cover and a little overstory cover will remain from smaller trees and fir trees unaffected by beetles but this cover would not be sufficient for golden-crowned kinglet habitat needs.

Overall, no action could allow the maturing of forested habitat with increases in spruce-fir habitat through succession. These actions could increase golden-crowned kinglet habitat. An important component of golden-crowned kinglet habitat, snags for roosting sites, would be increased by a combination of insect outbreaks, tree pathogens, and wildfires. However, this combination of events can also reduce the live structure of the forest, potentially reducing golden-crowned kinglet habitat if these natural events are widespread. Growth of the existing understory would reproduce golden-crowned kinglet habitat, mature lodgepole with closed canopy, in about 100 years if these events are widespread.

So, it is expected that loss of mature lodgepole to beetles will cause the loss of some golden-crowned kinglet habitat due to the loss of live canopy cover. Potential golden-crowned kinglet habitat corresponds to spruce-fir forest of structural stages 4A through 4C and 5 and lodgepole of stages 4B, 4C, and 5. There are currently more than 409,828 acres of habitat on the Forest. Where mature tree loss is complete and widespread in lodgepole, there would be more than 188,174.35 acres of habitat remaining on the Forest. The golden-crowned kinglet would still be distributed across the Forest since their primary habitat, mature and older spruce-fir, would still occur throughout the Forest.

Cumulative effects for No Action

Habitat immediately adjacent to the current road system provides reduced quantity and quality habitat to wildlife. Some research has found, for example, that edge effects of roads extend 50m into the forested habitat (Tinker et al. 1998). Prey insects should be abundant but vehicle and visitor disturbance and firewood cutting could discourage golden-crowned kinglet use. There are still several hundred thousands of acres of nesting and foraging habitat across the Forest away from roads.

Potential future increase in spruce-fir by successional replacement of lodgepole and the maturing of existing spruce-fir would provide increased nesting and foraging habitat quality. However, this would not occur where beetles restarted succession in lodgepole stands.

Catastrophic fire events from increased fuel loads within beetle-killed stands across the Forest would also affect golden-crowned kinglet habitat. Burned conifer stands would have too much canopy loss to provide habitat for golden-crowned kinglets.

Nesting habitat and foraging habitat are expected to decline initially under complete and widespread beetle-kill. This decline will be caused by the sharp decrease in canopy cover. Some understory cover will remain since beetles will not affect small spruce or lodgepole or any fir trees. This understory will again provide golden-crowned kinglet habitat within 100 years.

Some timber harvest is occurring or is planned to occur across the Forest. These acres would retain snags, recruitment trees, and coarse woody debris to provide some foraging opportunity. Stands will regenerate to nesting habitat within approximately 100 years.

The benefit of the no action worst-case scenario to golden-crowned kinglet in the long term is that widespread beetle outbreak will provide large expanses of high densities of snags for communal winter roost sites. Dillon et al. (2003) indicated that snags are probably lower than HRV on the Forest due to past management. The beetle caused changes would move habitat toward "composition, structure, patterns, and processes toward conditions typical of those created by natural processes", a Forest Plan objective for MIS.

Effects of the Proposed Action (Alternative 2) to the Golden-Crowned Kinglet

Direct Effects and Indirect Effects

There are currently more than 409,828.00 acres of golden-crowned kinglet habitat across the Forest. Proposed harvest in lodgepole stands would eliminate 10,312 acres of golden-crowned kinglet beetle-killed habitat near admin features across the Forest over 10 years. Forest plan standards for recruitment trees, snags and coarse woody debris will retain some habitat features for prey insects in harvest areas. This will be low quality foraging habitat for approximately 50 years when forest structure becomes complex. These stands could return to nesting habitat in approximately 100 years as the regenerating forest matures.

Most of these acres would already be unsuitable as golden-crowned kinglet habitat due to the loss of cover as discussed earlier. Forest plan standards for recruitment trees, snags and coarse woody debris will retain some habitat features that will be useful when the stand regenerates. These standards will provide these features of wildlife habitat within the Historic Range of Variability (HRV); so, they will provide habitat features of cover and forage for the MIS golden-crowned kinglet.

The loss of 10,312 acres is spread across many territories. Harvest is distributed widely across the Forest in small strips around admin features, Forest Plan standards for recruitment trees, snags, and coarse woody debris will retain some habitat features, and proposed action is not affecting the preferred mature spruce-fir habitat. So, the effect will likely be that most golden-crowned kinglets that lose habitat to harvest will gain suitable habitat in adjacent areas away from admin features. Only a few territories are likely to be lost. Habitat changes from harvest, beetles, and forest regeneration over time will ensure a continuing supply of prey and future nesting habitat and will contribute toward maintaining the golden-crowned kinglet population on the Forest. This amount of change is well within the range of natural changes to the Forest. Some foraging habitat will always be available but nesting habitat will return in harvested stands within 100 years.

The temporary loss of a few territories to harvest would reflect the corresponding loss of canopy cover in some old forest due to harvest.

Cumulative Effects of the Proposed Action

Habitat immediately adjacent to the current road system provides reduced quantity and quality habitat to wildlife. Some research has found, for example, that edge effects of roads extend 50m into the forested habitat (Tinker et al. 1998). Prey insects should be abundant but vehicle and visitor disturbance and firewood cutting could discourage golden-crowned kinglet use. There are still several hundred thousands of acres of nesting and foraging habitat across the Forest away from roads.

Potential future increase in spruce-fir by successional replacement of lodgepole and the maturing of existing spruce-fir would provide increased nesting and foraging habitat quality. However, this would not occur where beetles restarted succession in lodgepole stands.

Catastrophic fire events from increased fuel loads within beetle-killed stands across the Forest would also affect golden-crowned kinglet habitat. Burned conifer stands would have too much canopy loss to provide habitat for golden-crowned kinglets.

Nesting habitat and foraging habitat are expected to decline initially under complete and widespread beetle-kill. This decline will be caused by the sharp decrease in canopy cover. Some understory cover will remain since beetles will not affect small spruce or lodgepole or any fir trees. This understory will again provide golden-crowned kinglet habitat within 100 years.

Some timber harvest is occurring or is planned to occur across the Forest. These acres would retain snags, recruitment trees, and coarse woody debris to provide some foraging opportunity. Stands will regenerate to nesting habitat within approximately 100 years.

Implementation of the project could result in disturbance to individual golden-crowned kinglets and/or their nest sites. Suitable habitat would be reduced by implementation of the proposed action. Adult birds would simple fly away from this disturbance and not suffer any real impact. Impacts to nest and young are possible if logging operations

occur during the nesting season. Because of the relative small scale of this management action in the kinglets preferred habitat, implementation of an action alternative is not anticipated to affect the population trend of this species at the scale of the National Forest planning area. In the long-term spruce-fir covertype will recover and provide habitat for this species.

Northern Goshawk (Accipiter gentilis)

The northern goshawk was selected as an MIS to represent issues associated with lodgepole-pine timber management. Goshawks are seasonal breeders on the Routt National Forest but may use habitat within the Forest, or nearby, at all times of year. Refer to the Environmental Assessment for Management Indicator Species Forest Plan Amendment 04 and the associated Decision Notice for more information regarding this species selection as an MIS (USDA Forest Service, 2007).

Natural History — "Like other members of the genus *Accipiter*, the goshawk is a bird of coniferous, deciduous, or mixed forests" [Reynolds *et al.* 1992, p. 10]. During the breeding season, this forest hawk inhabits live mature or old-age coniferous and mixed conifer/aspen forests, having relatively high canopy closure, often in association with small, interspersed openings or wetlands (DeGraff *et al.* 1991, Squires and Reynolds 1997, Kingery 1998, Kennedy 2003). Preferred habitat near the nest is older, tall; single-story forests of large trees and high stem densities with an open understory where these fast birds can maneuver under the canopy (Squires and Reynolds 1997, Kingery 1998, Kennedy 2003). Often, nest stands are on slopes with northerly exposures or they are located in drainage bottoms protected by such slopes (Squires and Reynolds 1997, Reynolds *et al.* 1992). On the Routt National Forest, goshawks nearly always construct their nests in either lodgepole pines or aspens and these 2 tree species are selected in almost equal proportions (unpublished data on file). In a few instances, goshawks have constructed nests in another conifer species, such as subalpine fir.

A goshawk's breeding season home range in Arizona and New Mexico is reported to average about 6,000 acres (2430 ha) in size (Reynolds *et al.* 1992). However, Squires and Reynolds (1997) report that home range sizes throughout North America can vary from 1400 to 8650 acres (570 to 3500 ha). Unfortunately, no studies have been conducted on national forests in Region 2 to determine an average home range size for goshawks here (Kennedy 2003). On the Routt National Forest, though, the regular dispersion and average distance between known nests suggests goshawks probably use fewer than 3500 acres (1416 ha) during the breeding season. The mean distance between occupied nests in contiguous suitable habitat is about 2 miles (Skorkowsky, personal communication). According to researchers, goshawk pairs partition use of forest stands in their home range into 3 key areas during the breeding season: nesting area, post-fledging area, and foraging area (Reynolds *et al.* 1992). Forest conditions, and the importance of various habitat components (tree size, canopy closure, understory openness, *etc.*) in each of the 3 areas, differ according to use.

Goshawks have evolved to maneuver adroitly amongst trees and other foliage in pursuit of their prey (Squires and Reynolds 1997). These hawks are saltatory (stop-and-go) predators that hunt from perches in the lower forest canopy (Kennedy 2003). They

launch to pursue their prey at tremendous speed over short distances and are highly adept at going after birds within or beneath the forest canopy (Kingery 1998). Their diet consists mostly of birds including woodpeckers, corvids (jays, crows, *etc.*), thrushes, finches, grouse, quail, sparrows, owls, doves, ducks and smaller hawks (Squires and Reynolds 1997, Squires 2000, Kennedy 2003). One-third or (sometimes substantially) more of their food intake, however, is comprised of mammals such as sciurids (including tree squirrels, ground squirrels and chipmunks), rabbits, mice, weasels, shrews, marten, muskrat, and deer carrion (Squires and Reynolds 1997, Reynolds *et al.* 1992, p. 10]. During the breeding season, this forest hawk inhabits live mature or old-age coniferous and mixed conifer/aspen forests, having relatively high canopy closure, often in association with small, interspersed openings or wetlands (DeGraff *et al.* 1991, Squires and Reynolds 1997, Kingery 1998, Kennedy 2003). Preferred habitat near the nest is older, tall; single-story forests of large trees and high stem densities with an open understory where these fast birds can maneuver under the canopy (Squires and Reynolds 1997, Kennedy 2003). Insects, including grasshoppers and caterpillars, are also eaten (DeGraff *et al.* 1991).

Squires (2000), in his study of goshawk food habits in south central Wyoming (Medicine Bow National Forest), examined the contents of 793 regurgitated pellets collected from 40 nests to identify the percent occurrence of consumed prey. Based on percent occurrence of prey remains in those pellets, he found red squirrels (*Tamiasciurus hudsonicus*) were the mammalian prey most often eaten (50% frequency) while northern flickers were the most commonly identified avian prey found in pellets (34% frequency).

Population Status, Abundance, and Trend — A national working group convened by the Forest Service has developed a goshawk monitoring protocol for application at a bioregional (*e.g.*, southern Rocky Mountains) scale (Woodbridge and Hargis 2006). The final sampling design and monitoring protocol was published in 2006 as a Forest Service technical guide (GTR WO-71). The national protocol was implemented in 2006 within Forest Service Region 2. The overall estimate of occupancy for 2006 was 0.329 (95% CI: 0.213–0.445). Within primary habitat (pines and aspen) the occupancy estimate was 0.811 with a standard error of 0.113. Within secondary habitat (typically spruce-fir) the occupancy estimate was 0.124 with a standard error of 0.067. These results are currently in draft manuscript form and are anticipated to be published in 2008 (Beck et. al, 2008 and Skorkowsky et. al, 2008). Further implementation is planned for 2009 and trend is anticipated by 2012.

Although empirical data currently are lacking to enumerate a goshawk population trend within this bioregion, an assessment of existing habitat conditions on the Routt National Forest offers a useful approach for indirectly approximating current goshawk population abundance and trend locally. Habitat can be appropriate as a surrogate for direct population enumeration since there is a certain and positive relationship between the numbers of breeding pairs supported (or potentially supported) in an area and the amount of suitable habitat present (or potentially present). Recognizing that a top-tier predator such as the goshawk would never be "common" in abundance within any landscape and that the density of breeding pairs is low (Squires and Reynolds 1997), it is nonetheless possible to approximate the maximum potential carrying capacity within a large geographic area using assumptions of minimum territory size and greatest extent of

suitable habitat.

On the Routt National Forest, treed cover types have been analyzed to estimate the overall suitability and capacity of existing forest stands to support goshawk breeding. Using a geographic information system (GIS), presently available suitable breeding habitats were identified by comparing attributes of existing cover types with the vegetative attributes known to encompass the variability of goshawk nest stands located on the Forest. In total, approximately 645,000 acres of mature or old-age forest stands were found to include the tested attributes (*e.g.*, tree size, tree species, stem density, *etc.*) of known goshawk nest sites. Then, the pattern and average distance between goshawk territories (established from known nest sites located on the Forest) was used to roughly estimate the maximum number of potential goshawk nesting territories that could be enclosed within suitable habitats. This maximum estimate was subsequently adjusted downward by applying variables that account for prey species richness (again, using judgment to select several habitat attributes known to foster small birds and mammals important as goshawk prey) and by apportioning a minimum number of mature forest acres to each potential goshawk territory. Once these adjustment factors were applied, a total of approximately 250 nesting territories can nominally be placed within the Routt National Forest.

In actuality, though, the number of goshawk pairs that could be resident on the Routt National Forest during any single breeding season would be considerably fewer than 250. Several considerations are not accounted for in the estimate of potential breeding territories that may substantially reduce suitable habitats actually available to breeding goshawks. For example, competition among conspecifics, interspecific competition with other raptors for nest sites and food, annual or cyclic fluctuations in prey availability and vagaries of suitable habitat not accounted for within the analysis described above suggest that 250 nesting territories greatly overstates real carrying capacity. Most likely, the current extent of suitable habitats is capable of supporting only a portion of the estimated 250 territories, either presently or at any future time.

The estimate does illustrate, however, that the acreage of suitable breeding habitat available is probably near a maximum on the Forest. Considering only National Forest System lands administered by the Routt, 51 percent (645,000 acres) of the entire 1,254,178-acre Forest is now covered in mature-and-older stands that have sufficiently-large tree sizes to support goshawk breeding. When omitting the land areas within the Forest that are non-forested (areas above timberline and sagebrush parks), together with forested areas that can not support large trees, it seems unlikely that there would ever be a much larger acreage than is now available. In all, the quantity of suitable breeding habitat currently accessible to breeding goshawks is probably at a near-maximum in the context of the natural range of variation. Given the extensive acres of suitable habitat available, but recognizing factors not explicated in the estimate of maximum breeding territories available on the Forest, the actual number of sustainable breeding territories likely is closer to 100 than it is to 250.

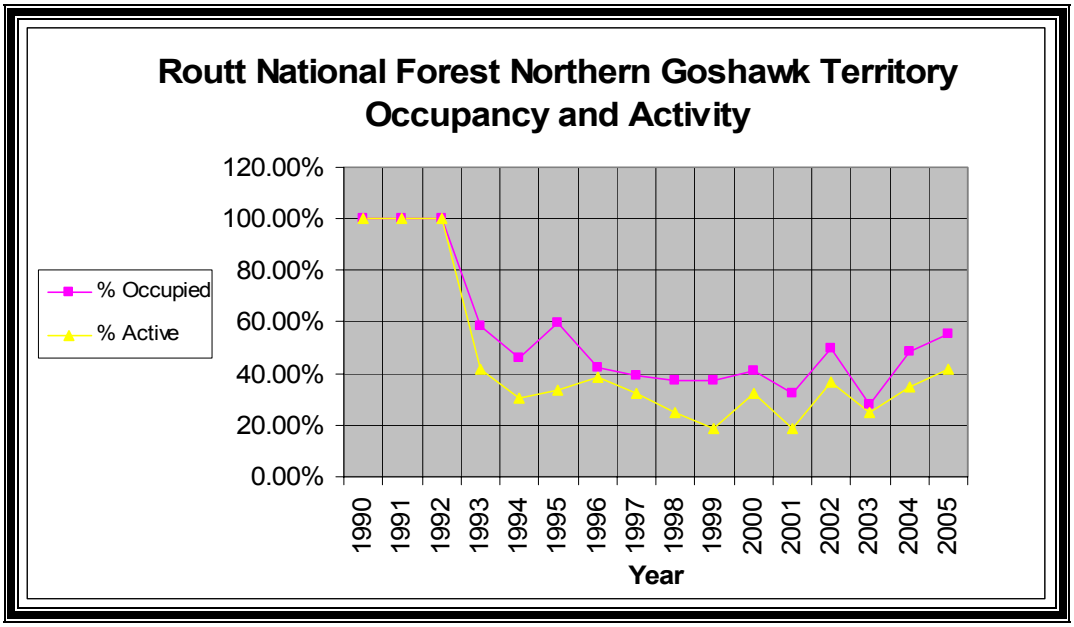
Certainly, over the span of the last half-century, absolute numbers of goshawks have risen each decade because the expanse of suitable habitat has increased. Forest-wide, mature and old-age forests predominate and many stands are at a nearly ideal developmental stage for goshawk habitation. Moreover, older forests are nearly at their

maximum area extent because extensive areas of subalpine forest on the Routt (and in Colorado generally) were synchronously regenerated during the last of the 19th century by forest fires and logging. Since the early part of the 20th century, lodgepole pine and spruce/fir forests have been on a steady trajectory of maturation, producing unusually homogenous landscapes of mid-age and large-tree stands in the subalpine zone. These large trees and the relatively closed canopy now available in most subalpine forests is the natural outcome of a long interval since the last stand-replacement disturbance. Because a large live tree is essential for supporting the bulky, heavy nest that goshawks construct, young age classes of rejuvenating forests are just not suitable for goshawk breeding regardless of the quantity or availability of inherent food resources. Undoubtedly, current goshawk numbers are commensurate with this expansive area of mid to late-successional forest stands (approximately 645,000 acres on the Routt) dominating the Elkhead, Park, Gore and Rabbit Ears ranges within the Routt National Forest. Therefore, overall goshawk abundance across the Forest should currently be comparatively high and the population may be near a peak.

The proposition that current forest stands are now well-suited for goshawks is supported by the continual discovery each year of new goshawk nest stands. Wildlife personnel on the Routt National Forest have conducted detection surveys for northern goshawks annually since 1992. While these detection surveys have not been accomplished with uniform effort and survey sites were not randomly selected, surveys have successfully located numerous goshawk nests and breeding territories. To date, more than 50 goshawk breeding areas (nesting territories) have been located across the Forest, primarily on those lands allocated to intensive timber production. There are five known nests within five territories in the analysis area that contained active nests within the last five years. There are thirty seven nests from 25 territories within ¼ mile of proposed actions. The analysis area has 320,120 acres of suitable goshawk habitat, and the proposal is to harvest 10,204 acres of this habitat.

Routt National Forest MIS Monitoring - The Routt National Forest has implemented a MIS monitoring protocol for monitoring goshawks on the Routt National Forest as a Management Indicator species (Skorkowsky, 2005). This monitoring program has indicated that territory activity and occupancy has typically been relatively stable over the last 10 years. In this monitoring data set, years 1990-1995 are not good representations of average territory occupancy or activity levels due to limited sample size.

Figure 2 – Northern Goshawk Territory Occupancy and Activity by Year.



Conclusions — In consideration of the information about former and existing habitat conditions Forest-wide, together with an understanding of goshawk biology, the presented evidence suggests the population trend for *A. gentilis* on the Routt National Forest has been on an upward inclination until recently and now the trend may be at or approaching stability. Known goshawk nesting territories on the Routt demonstrate these birds to be widely distributed on the Forest and they are well-distributed within suitable habitat (Skorkowsky et. al, 2007). Evidence from Region and Forest-wide goshawk surveys, suggests goshawk breeding pairs are common and well distributed but occur at low-density on the landscape.

Effects of the No Action (Alternative 1) to the Northern Goshawk

Direct Effects and Indirect Effects

There are 60 known goshawk nests within 50 territories across the Forest.

Natural fire regimes, endemic levels of insects and pathogens play significant ecological roles including tree mortality, defoliation, decay, and deformity. These processes are important attributes in goshawk foraging and nesting habitat. No action will result in variable effects to northern goshawks.

Habitat selected for nesting by Northern goshawks (Squires and Ruggiero 1996) consists of closed-canopied, single-layered lodgepole and lodgepole/aspen stands with large trees

and open understories (aspen and lodgepole 4B, 4C and 5, below 9200 ft.). Squires and Ruggiero (1996) found that nesting habitat had a mean canopy closure of 65%. Limited research has found that some goshawks continue to nest successfully in lodgepole pine forests where up to 80% of the overstory trees were killed (Graham et al. 1999, Dalton 2005) until the beetle-killed trees fall.

Under No Action, some goshawks are expected to continue to nest in beetle-killed stands near these administrative features (roads/trails, administrative sites) until the nest trees and the stand deteriorates over 10 to 20 years. Goshawks would have to move to suitable aspen or nonbeetle-killed lodgepole to continue nesting. Natural regeneration of lodgepole after beetle-kill could reproduce nesting habitat as soon as 80 years after these events.

Goshawks could also continue to use these administrative feature areas for foraging for years, if not for nesting. Goshawks are opportunistic foragers and adapt their diet to take advantage of prey abundance. They have been found to prey on more than 30 species (Squires 2000) and forage in a variety of forest types and successional stages (Reynolds et al. 1992). For example, natural tree mortality from beetles would attract woodpecker prey species while there would be a concurrent decline in red squirrel prey as cone resources are lost. Lodgepole regenerating after natural disturbances and increased understory productivity would create habitat for snowshoe hare prey species for some time. There could be a general reduction in goshawk foraging habitat quality as forest structure is lost since many prey species are the mature forest species that will no longer occur in these stands (Chan-McCleod 2006, Martin et al. 2006). Overall, it is expected that foraging habitat will remain abundant, quality will be reduced, prey species composition will change, and there will be a small reduction in total prey abundance due to the extensive loss of forest structure.

Cumulative Effects

Habitat for many prey species and, therefore, prey abundance is expected to decline somewhat across the Forest under no action. Beetle-killed stands will still provide some habitat for a variety of prey species that exist across the Forest. However, the quality of this foraging habitat will be reduced in many areas where there is a dramatic loss of live vegetation structure in beetle-killed trees across thousands of acres.

Catastrophic fire events from increased fuel loads within beetle-killed stands across the Forest would also change goshawk habitat. Stands would not be suitable for nesting after a catastrophic wildfire. There would not be sufficient standing trees and snags to be suitable for nesting.

This burned habitat would still provide some foraging habitat. Insects within dead trees and coarse woody debris would attract woodpecker prey animals. Some snowshoe hare habitat would be created over time where understory vegetation was restored in abundance and when later lodgepole regeneration occurred.

The final extent of loss of nesting habitat to pine beetles or potential wildfires across the Forest is unknown. Surveys indicate that 223,000 acres had already been affected by beetle-kill by 2006. Some of this is comprised of the closed-canopied, single-layered lodgepole with large trees used for nesting by goshawks. Some nesting habitat will always be available across the Forest since goshawks also nest in mature aspen, not every stand of mature lodgepole across the Forest is likely to be lost, and some younger stands will mature to suitable nesting habitat over the next few decades.

Habitat immediately adjacent to the current road system provides reduced quantity and quality habitat to wildlife. Some research has found, for example, that edge effects of roads extend 50m into the forested habitat (Tinker et al. 1998). Far fewer goshawk nests are located adjacent to roads across the Forest and prey animal habitat quality is expected to be reduced. There are still several hundred thousands of acres of nesting and foraging habitat across the Forest away from roads.

In total, there will be a reduced amount of nesting habitat acres and some reduced quality of foraging habitat across the Forest. Goshawks might occupy some territories for years without nesting or nesting unsuccessfully. Some territories with lodegepole nesting habitat probably won't be affected by beetles; some territories also have aspen nesting habitat. The goshawk population across the Forest probably won't decline since adults will still occupy territories where beetles have killed the lodgepole nesting habitat. The population is not expected to increase either since Forestwide goshawk recruitment will be reduced.

Effects of the Proposed Action (Alternative 2) to the Northern Goshawk

Direct Effects and Indirect Effects

There are 60 known goshawk nests within 50 territories on the Routt NF. There are five known nests within five territories within proposed actions. Several of these areas contained an active nest in the last 5 years. Beetles could kill enough trees to reduce overstory cover to a point that goshawks will no longer use these stands for nesting. However, some goshawks have continued to use nests in lodgepole pine where up to 80% of the overstory trees were killed by pine beetle outbreaks (Graham et al. 1999) until these snags fell over. If goshawks abandon nesting in these beetle-killed stands, treatment can proceed. If goshawks continue to use the nesting areas in these treatment sites despite beetle-killed trees, Forest Plan standards for nesting raptors will be applied (p.1-14) through Design Criteria, and treatment should not occur or should be appropriately adjusted. Surveys (Kennedy and Stahlecker 1993) for an active goshawk nest or occupied territory should be completed before treatment proceeds in order to ensure that Forest Plan standards for goshawks (p.1-14) are met. This process is generally identified in proposed action design criteria 13 and 14 but will be more thoroughly explained in the design features at the end of this report.

There are 37 nests from 25 known territories within ¼ mile of proposed actions. If goshawks use the nesting areas within ¼ mile of these treatment sites despite beetle-

killed trees, Forest Plan standards for nesting goshawks should be applied and treatment should be appropriately adjusted. Surveys (Kennedy and Stahlecker 1993) for an active goshawk nest or occupied territory should be completed within ¼ mile of these proposed action sites within suitable habitat before treatment proceeds in order to ensure that Forest Plan standards for goshawks are met.

There are currently about 320,120.00 acres of nesting habitat (aspen and lodgepole stages 4B, 4C, and 5 below 9200 ft. elevation) across the Forest. Proposed harvest in lodgepole stands would eliminate 10,204.20 acres of potential nesting habitat across the Forest over 10 years. Some goshawks might have used these beetle-killed stands for nesting (see Graham et al. 1999) while others would use the stands only for foraging. Surveys for active goshawk nests (Kennedy and Stahlecker 1993), as identified in design features, will ensure that Forest Plan standards are followed and active nesting is protected. Harvested areas could return to nesting habitat in approximately 80 years as the regenerating forest matures and canopy cover increases.

All proposed action sites would retain some foraging habitat but habitat quality would be affected by reducing forest structure, reducing snags, dead topped trees and coarse woody debris. Forest Plan standards for snags, recruitment trees, and coarse woody debris will retain required amounts of these features. There will also be a concurrent habitat change resulting from beetle-killed trees. Primary prey species such as three-toed woodpeckers would initially increase while red squirrels would decline from these habitat changes (Martin et al. 2006). The subsequent grass/forb stages would benefit alternate prey species such as golden-mantled ground squirrels, deer mice, and montane voles. Later regeneration to a shrub-like understory would benefit alternate prey species such as snowshoe hare and blue grouse. Reynolds et al. (1992) indicated that consistent abundance and wide variety of prey might determine population stability. Secondly, Graham et al. (1999) indicated that managing for a variety of habitats will manage for goshawks over time.

Goshawks would be expected to leave the immediate area surrounding treatment units due to the noise disturbance caused by mechanical equipment. Immediately after harvest, goshawks could return to those treated areas for foraging.

<u>Cumulative effects</u>
Habitat for many prey species and, therefore, prey abundance is expected to decline somewhat across the Forest under proposed action. Harvested stands and beetle-killed stands will still provide some habitat for a variety of prey species that exist across the Forest. However, the quality of this foraging habitat will be reduced in many areas where there is a dramatic loss of live vegetation structure from harvested stands and from extensive acres of beetle-killed trees across thousands of acres.

Catastrophic fire events from increased fuel loads within beetle-killed stands across the Forest would also change goshawk habitat. Stands would not be suitable for nesting after a catastrophic wildfire. There would not be sufficient standing trees and snags to be suitable for nesting.

This burned habitat would still provide some foraging habitat. Insects within dead trees and coarse woody debris would attract woodpecker prey animals for several years. Some snowshoe hare habitat would be created over time where understory vegetation was restored in abundance and when later lodgepole regeneration occurred.

The final extent of loss of nesting habitat to pine beetles or potential wildfires across the Forest is unknown. Surveys indicate that 223,000 acres had already been affected by beetle-kill by 2006. Some of this is comprised of the closed-canopied, single-layered lodgepole with large trees used for nesting by goshawks. Some nesting habitat will always be available across the Forest since goshawks also nest in mature aspen, not every stand of mature lodgepole across the Forest is likely to be lost, and some younger stands will mature to suitable nesting habitat over the next few decades.

Some timber harvest is occurring or is planned to occur across the Forest, combined the proposed action will also remove up to 18,437.20 acres of nesting habitat over 10 years. Some of these acres would probably be lost to nesting without harvest. Stands will regenerate to nesting habitat in approximately 80 years.

Habitat immediately adjacent to the current road system provides reduced quantity and quality habitat to wildlife. Some research has found, for example, that edge effects of roads extend 50m into the forested habitat (Tinker et al. 1998). Far fewer goshawk nests on the Forest are located adjacent to roads and prey animal habitat quality is expected to be reduced. There are still several hundred thousands of acres of nesting and foraging habitat across the Forest away from roads.

In total, there will be a reduced amount of nesting habitat acres and some reduced quality of foraging habitat across the Forest. Goshawks might occupy some beetle-killed territories for years without nesting or nest unsuccessfully. However, some territories could be lost to beetles if goshawk supporting prey cannot be found. Overall, the fundamental outcome of the MPB outbreak is that goshawk nesting and foraging habitat would be detrimentally affected. Direct, indirect and cumulative adverse impacts will accrue to nesting pairs of goshawks whether people intervene in the beetle outbreak or not. Inevitably, over the intermediate-term, important elements of goshawk reproductive habitat are likely to decrease substantially. A sharp decrease in overhead canopy closure from mortality of most or all large live pines would directly reduce the suitability of existing habitats for nesting. Tree mortality would also contribute indirectly to substantial declines in small bird and mammal prey, especially red squirrels (Yeager and Riordan 1953). In turn, reduced prey abundance or availability would contribute to lack of reproductive success for goshawk pairs, most or all of the time. Thus, with the largest trees in a stand killed, goshawks lose suitable nest trees and protective canopy cover while also suffering a decline in the availability and abundance of the birds and mammals they depend upon for food. As a result, goshawks may abandon altogether a territory where substantial or complete mortality of large lodgepole pines occurs. Should fire burn through beetle-killed stands, adverse effects would be exacerbated and complete non-use of the area by goshawks would be expected for 60 to 100 years.

Some territories with lodegepole nesting habitat probably won't be affected by beetles; some territories have also aspen nesting habitat. Harvested areas will be spread across distance and time, so there would be little impact to any individual goshawk territory from harvesting. The goshawk population across the Forest probably won't decline since adults will still occupy territories where beetles have killed the lodgepole nesting habitat, territories with harvest and beetle-killed stands will likely retain some unaffected nesting habitat, and aspen nesting habitat is still available. Still, the population is not expected to increase either since Forestwide goshawk recruitment will be reduced.

In the longer run, though, partial cuts in mature lodgepole pine are expected to result in stands that are more open beneath the live crowns and that have larger tree sizes. Plant growth and succession would gradually improve habitat conditions that support small mammals and birds. Over the long-term, young trees and other vegetation would expand into, or be competitively advantaged by, new growing space created by cut/killed trees. The residual mature lodgepole pines that form the stand overstory would increase in both diameter and crown volume due to the reduced competition among trees (Oliver and Larson 1996). In addition, damaging agents such as MPB, wind and ice would operate to wound or kill some lodgepole pines and other trees, adding structural complexity in the overhead canopy. Together, over a period of 2 or more decades, structural complexity, canopy cover and tree size would increase. Concurrently, prey abundance would increase and larger tree sizes may continue to provide for goshawk foraging or nesting.

Overall, proposed and on-going actions will retain more than 301,000 acres of suitable nesting habitat on the Forest. These acres will continue to provide suitable nesting habitat and post-fledging areas (Reynolds et. al 1992) for the more than 50 known territories on the Forest. Harvested areas will provide foraging habitat and may become nesting habitat in 80 years. Habitat changes from harvest, beetles, and forest regeneration over time will provide variety in prey available and will contribute toward the stability of the goshawk population on the Forest.

Landbirds

An existing executive order (dated 01/11/01) directs Federal agencies to protect migratory birds. A follow-up Memorandum of Understanding (MOU) between the USFS and USFWS (dated 1/16/01) was developed to complement and implement this executive order in a collaborative effort between the two agencies. The EO and MOU have been reviewed. This analysis and project are consistent with criteria in these documents for the protection of migratory birds. Migratory birds of special interest are included in a recent cooperative conservation effort, referred to as Partners in Flight (PIF). Many of the birds identified as priority species of level I or II are included in this Specialist's Report for MIS or the Biological Evaluation (BE).

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