Hazard Tree Removal Project

Terrestrial Wildlife Existing Condition, Management Indicator Species, and Forest Plan Compliance Reports

Medicine Bow-Routt National Forests
Thunder Basin National Grassland
P.O. Box 249, Saratoga, WY 82331

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EXISTING CONDITION

Much of the following information was taken directly from the scoping statement that advised the public of this hazard tree project. The descriptions below are part of the environmental baseline for the analysis area.

The Hazard Tree Analysis Area (AA) includes all of the Medicine Bow-Routt National Forests. However, all Wilderness areas and the Medicine Bow's Laramie Peak area will not include any proposed activities. This report addresses USFS Region 2 Sensitive Species for the Medicine Bow Forest portion of the analysis area. The Routt National Forest portion of the analysis area is addressed in separate reports. The Medicine Bow Forest analysis area is dominated by lodgepole pine and spruce/fir, 44% and 18%, respectively, of the 1,084,614 acres on the Forest.

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	3,168	1,896	15,809	17,245	8,003	14,822	13,427	5,009	4,307
Cottonwood	0	0	0	84	25	41	122	128	7	0
Douglas-fir	0	131	0	232	359	1,403	2,407	2,678	1,525	1,561
Gambel oak	0	0	0	0	43	0	0	0	0	0
Limber pine	0	54	270	5,870	759	200	2,896	1,160	177	246
Lodgepole pine	0	13,561	41,645	44,307	64,861	87,408	39,758	86,858	54,329	39,849
Ponderosa pine	0	4,284	446	2,685	2,985	976	43,250	32,197	7,046	2,080
Spruce/fir	0	4,766	8,899	15,260	6,270	3,854	30,579	41,537	28,037	52,493
Juniper	0	0	0	154	0	0	89	0	0	0
Total Forested	**0**	**25,964**	**53,157**	**84,401**	**92,546**	**101,885**	**133,924**	**177,985**	**96,132**	**100,537**
HSS as % of Total Forested	**0**	**3.0%**	**6.1%**	**9.7%**	**10.7%**	**11.8%**	**15.5%**	**20.5%**	**11.1%**	**11.6%**
HSS as % MBNF for Forested		**2.4%**	**4.9%**	**7.8%**	**8.5%**	**9.4%**	**12.3%**	**16.4%**	**8.9%**	**9.3%**
Total Non-forested	**10,593**	**76,551**	**130,537**	**2**	**2**	**72**	**250**	**35**	**36**	**4**
HSS as %MBNF for Non-Forested	**1.0%**	**7.1%**	**12.0%**	**<0.1%**	**<0.1%**	**<0.1%**	**<0.1%**	**<0.1%**	**<0.1%**	**<0.1%**
Total	**10,593**	**102,515**	**183,693**	**84,403**	**92,549**	**101,958**	**134,174**	**178,020**	**96,168**	**100,541**
HSS as % of Total	**1.0%**	**9.4%**	**16.9%**	**7.8%**	**8.5%**	**9.4%**	**12.4%**	**16.4%**	**8.9%**	**9.3%**

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.

Past Timber Harvest

There has been harvest in some portions of the Medicine Bow National Forest in the past. Vegetation changes caused by these actions and the subsequent regeneration are reflected in the existing condition (Table 1). However, some harvest units from the Ryan Park-Tenmile, Box Canyon, Blackhall/McAnulty, Singer Peak, Silver Run, White Rock Estates, Cottonwood Rim, Soldier Summit, French Creek and Devil's Gate projects and the proposed Spruce Gulch project have not yet

been treated, so these habitat changes are not reflected in the existing condition (Table 1). Future habitat changes caused by these projects are included in the cumulative effects analysis for the appropriate sensitive species.

Livestock Grazing

There are numerous cattle allotments across the Forest and several bands of domestic sheep grazing on the Sierra Madre range.

Recreation

Details about recreation across the Forest are included in the Specialist's report for recreation.

PURPOSE & NEED:

The description of the purpose and need is provided directly from the public scoping letter. The HFRA recognizes healthy forests or forest health as an integral part of forest management. The Proposed Action responds directly to forest health objectives as described in the HFRA.

The purpose of this project is to manage forest vegetation affected by the mountain pine beetle epidemic while reducing threats to public safety by felling and/or removing trees that are dead and dying along roads and trails, within and adjacent to Forest Service developed recreation sites (campgrounds, trailheads, etc.), and within and adjacent to Forest Service administrative sites of the Medicine Bow-Routt National Forests.

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 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;
- Maintain and/or reduce 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
- Salvage forest products in a timely manner to partially offset the cost of treatments.

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. Standing dead and dying trees would not be felled and/or removed within Wilderness Area boundaries.

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. 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, Forest Service Crews, Service contracts, timber sales, and Stewardship contracts could be used to remove the hazardous trees.

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

ALTERNATIVE 1– NO ACTION

Under the No Action alternative, standing dead and dying trees along state and county roads within the Forest boundary and along NFSRs would not be felled and/or removed. Standing dead and dying trees in and adjacent to Forest Service campgrounds, trailheads, and administrative sites would also not be removed. No attempt would be made to respond to the purpose of and need for the proposal.

Expectations are that emerging pine beetles from the existing epicenters will continue to spread into, and attack green, standing lodgepole pine. The outbreak has the potential to affect thousands of acres of lodgepole-dominated forests across the Forest.

Figure 1. Proposed Treatment on the Sierra Madre Range

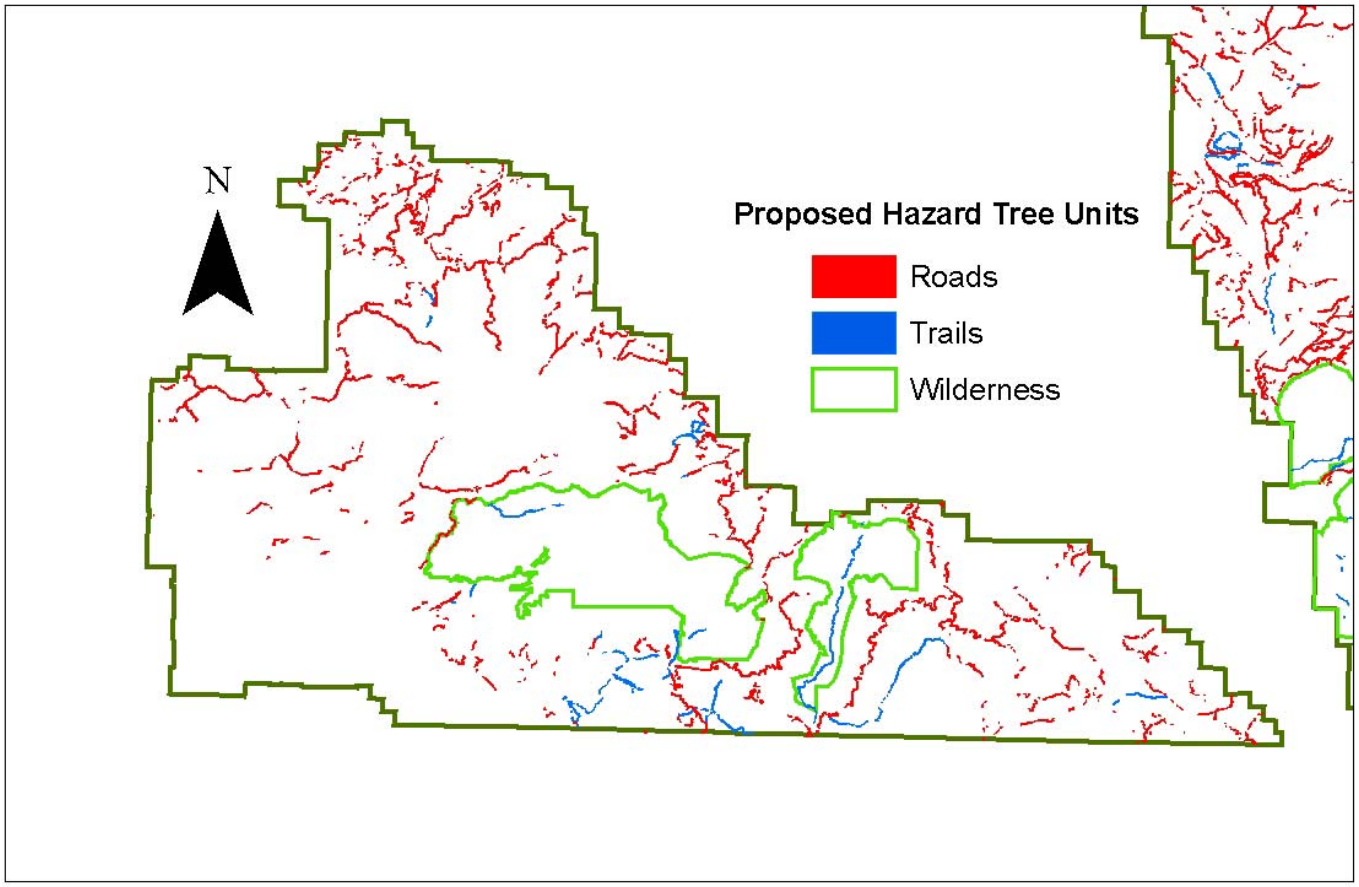
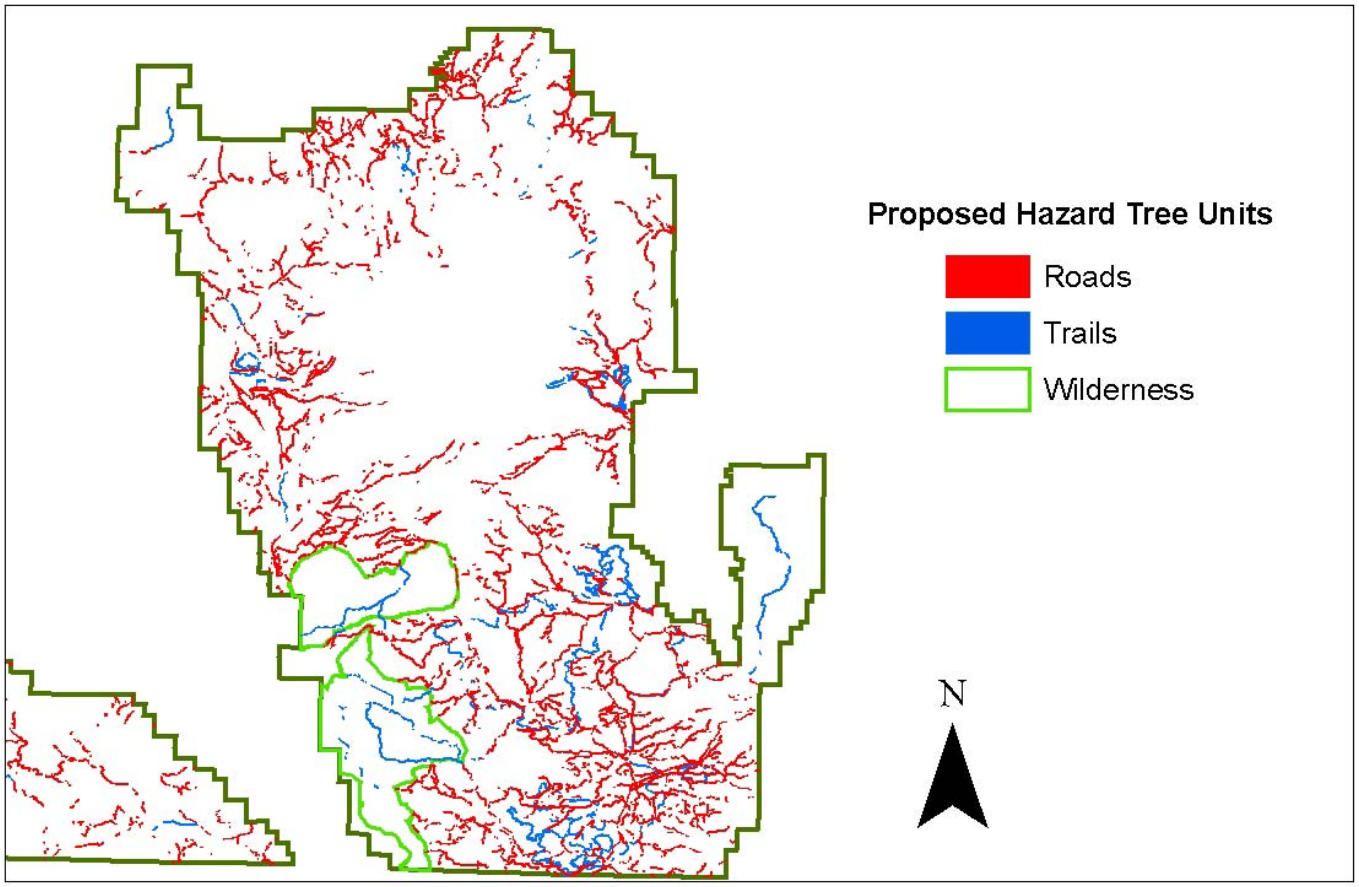


Figure 2. Proposed Treatment on the Snowy Range



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. 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. 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.

These changes could create an immediate substantial (1-10 years) loss of mature and older aged forest important to many Region 2 sensitive species such as goshawk, three-toed woodpecker, and American marten. These and other sensitive 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). 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.

Ward (undated) stated that foraging areas such as parks, meadows, and clearcuts must be protected from human disturbances such as vehicles and pedestrians. Elk prefer a buffer zone of 800m from pedestrians and 400m from moving traffic; mule deer prefer 180m from pedestrians and 90m from moving traffic. These distances may increase on winter ranges where timber is not accessible for cover. Most disturbing is traffic that is slow moving and where people are more apt to stop and get out of vehicles when they see animals.

Ward (1984) found elk and mule deer on the Medicine Bow National Forest were more disturbed by people in activities outside of their vehicles than traffic or equipment. Elk preferred to be at least ½ mile from people engaged in out-of-vehicle activities such as camping, picnicking, fishing, and harvesting timber.

Ward (1985) stated elk on the Medicine Bow National Forest stay about ½ mile from people walking on summer and winter ranges where there is an adequate supply of trees for security cover. Elk may be disturbed at greater distances, possibly 2 to 3 miles, on winter ranges where there are no trees.

Ward (1985a) studied elk in the Sierra Madre Mountains of southcentral Wyoming. He found that elk had a preference for timbered areas with lower road density or impossible roads due to snow depths or mud. The road itself was not a problem but the human activities associated with the road were the major concern for the welfare of the elk. Ward found 89% of radio-collar elk locations were ≥ ¼ mile from a road and 73% of locations were > ½ mile from roads in the Sierra Madres during hunting season.

Leptich and Zager (1991) found a strong inverse relationship between mature bull elk and road density. They found bull mortality rates were higher (62%) in highly roaded areas versus mortality (31.3%) in areas with few roads.

Hillis et al. (1991) indicated that elk vulnerability can be reduced and hunter opportunity can be increased by providing security areas for elk during the hunting season. To provide a reasonable level of bull survival, security areas were defined as nonlinear blocks of hiding cover > 250 acres in size and > ½ mile from any open road.

Geist (1971) found bighorn sheep to retreat from loud noises caused by recreationists, assuming this behavior to be an innate response to rockfalls and avalanches.

Canfield et al. (1999) reviewed many studies of human caused disturbance to ungulates. The summary of this review could be stated as human disturbance, particularly motorized vehicles, cause disturbance to bighorn sheep, elk, pronghorn, moose, and mule deer throughout the year, but especially during winter.

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 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.

Greater human dispersal provided by roads may also reduce the amount of snags and down and dead material since motorized access facilitates firewood collection and cutting (Hamann et al. 1999). These researchers suggested that firewood cutting was in direct conflict with woodpecker nest success because woodcutters harvested the material most valuable to woodpeckers for nesting (large standing snags…).

Proposed Action

Effects common to all species

Proposed actions can temporarily eliminate habitat for a particular sensitive 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 sensitive 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 Sensitive Species for a short time in untreated areas that are adjacent to hazard tree removal units. Individuals of Sensitive 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 sensitive 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 sensitive species.

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

All harvest units from the Ryan Park-Tenmile, Box Canyon, Singer Peak, Blackhall/McAnulty, Cottonwood Rim, Soldier Summit, Silver Run, White Rock Estates, French Creek, Devil's Gate projects and the proposed Spruce Gulch project have not yet been treated, so habitat changes are not reflected in the existing condition (Table 1). However, future habitat changes caused by these projects are included in the cumulative effects analysis for the appropriate sensitive species.

Species of Local Concern

The pika, brown-capped rosy finch, brown creeper, and bighorn sheep are species of local concern (USDA 2003, p. D-114). Habitat for pika occurs in talus slopes/outcrops of rock above 8000 ft. set in

tundra or broken subalpine forest. There is pika habitat in the analysis area but the proposed action will not occur within or near pika habitat or affect the pika or its habitat. No further analysis is necessary.

The brown-capped rosy finch occurs in the Snowy Range above timberline in low grass, cushion plant and lichen encrusted bare rock. Threats to this finch include isolation and disturbance associated with recreation. There is no finch habitat in the analysis area. No further analysis is necessary.

The brown creeper does occur in the analysis area. It occurs in large blocks of old spruce-fir and lodgepole forest. Threats include forest management that alters the structure of its preferred mature and old growth forest with reductions in basal area of lives trees, canopy closure, and the quantity, quality, and distribution of suitable snags. This habitat will be affected by the proposed action. Further analysis is necessary.

The Forest is comprised mostly of spring/summer/fall range for the Encampment River and Douglas Creek bighorn sheep herds. There is some lambing habitat within the Encampment River Wilderness and along the Platte River. There is winter range along the Platte River. Habitat for these sheep generally includes grassy meadows, rock outcrops, cliffs, and canyons, but also includes shrub stands adjacent to these features and above the Rivers. The major threat to this species is disease transmission from domestic sheep. No disease transmission will be promoted by the proposed actions. All proposed actions occur within bighorn spring/summer/fall range. No proposed actions will affect bighorn sheep habitat, their limiting factors, or their movements. No further analysis is necessary.

Brown Creeper

Alternative 1 – No Action

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 are important attributes in brown creeper habitat. No action could result in variable effects to brown creepers.

Potential brown creeper habitat across the Forest 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 300,000 acres of habitat across the Forest. It is likely that brown creepers use habitat adjacent to the Forest's open roads, trails, and administrative sites (collectively admin features). However, brown creeper use should be reduced since research mentioned earlier (p. 11-12) indicated wildlife habitat quality is reduced near roads.

Where pine beetles move through stands near admin features at epidemic levels, brown creeper habitat quality will change through time. Important components of brown creeper nesting, foraging and prey habitat, such as trees and snags with loose bark, would be increased by these insect outbreaks. Resulting snags would provide nesting habitat as long as sufficient density of live or dead canopy and limbs remained to prevent nest sites from being directly exposed to weather elements. These areas could still be used for foraging since the snags and dying trees will support an abundance of insect prey for years. Forest regeneration could produce nesting habitat again in approximately 100 years.

Cumulative effects

Habitat immediately adjacent to the current road system provides reduced quantity and quality habitat to wildlife (see p. 11-12). 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 brown creeper 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.

Prey abundance across the Forest is expected to increase substantially under the beetle outbreak. There should also be a sharp increase in nesting habitat across the Forest caused by the sharp increase in snags and trees with loose bark. This improved habitat will last as long as the beetle outbreak continues. When beetles decline again to endemic levels, the brown creeper density across the Forest will have a corresponding decline to normally expected level. Most beetle-killed trees from the next few years are likely to be still available as suitable nesting sites for several years. Overall, Forestwide nesting habitat quality is expected to increase through time under the beetle outbreak. The quantity of habitat will be dictated by how widespread the beetle outbreak becomes.

Catastrophic fire events from increased fuel loads within beetle-killed stands across the Forest would also affect brown creeper habitat. Widespread and intense wildfire across large areas of the landscape would eliminate brown creeper habitat for many decades. Approximately 100 years would be required for lodgepole stands to regrow and provide mature forest for foraging and trees or snags with loose bark for nesting.

The final extent of changes to brown creeper habitat from pine beetles or potential wildfires across the Forest is unknown. Surveys indicate that 75,000 acres had already been affected by beetle-kill by 2006. Much of this is comprised of large lodgepole trees potentially used for nesting and foraging. These acres would remain as nesting and foraging habitat under no action but the quality of this habitat would improve as long as standing dead trees and their limbs provide some cover. Brown creeper density in beetle-infested areas would be higher than in the surrounding forest. Brown creeper density would be expected to continue to be elevated as long as the beetle population continued beyond endemic levels as has been found in other forests (Martin et al. 2006). This habitat would only become unsuitable when snags have fallen and younger regeneration dominates the affected sites after several decades.

Some timber harvest is occurring or is planned to occur across the Forest. Harvest among the Ryan Park-Tenmile, Box Canyon, Singer Peak, Blackhall/McAnulty, Cottonwood Rim, Soldier Summit, Silver Run, White Rock Estates, French Creek, Devil's Gate projects and the proposed Spruce Gulch project will remove approximately 6000 acres of habitat across the Forest. This is only 2% of the more than 300,000 acres of potential habitat available 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 in approximately 100 years.

Some timber harvest occurred on state lands across the Forest. The state of Wyoming completed 380 acres of harvest and 5.2 miles of road construction among Billie Creek, Dudley Creek, and Damfino Creeks. All clearcuts these areas, 350 acres, are assumed to be suitable as brown creeper habitat. The 350 acres of harvest will temporarily eliminate these stands as brown creeper habitat. These stands will not be available as foraging habitat as regeneration occurs because state lands have no requirements to retain live trees, snags, or coarse woody debris that provide structural features to prey habitat. Nesting habitat will be lost for about 100 years until sufficient regeneration occurs and appropriate cavity nests are available.

In total, there will be an increase in nesting habitat quality and an increase in foraging habitat quality and quantity across the Forest. The brown creeper population across the Forest probably will increase in response to the beetle outbreak. The increase will last as long as the beetle outbreak then decline to normal levels.

Proposed Action

Direct Effects and Indirect Effects

There are currently more than 300,000 acres of brown creeper habitat across the Forest. Proposed harvest in lodgepole stands would eliminate 12,699 acres of brown creeper 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 until insects begin infesting suitable older trees again. These stands could return to nesting habitat in approximately 100 years as the regenerating forest matures.

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

Cumulative effects

Habitat immediately adjacent to the current road system provides reduced quantity and quality habitat to wildlife (see p. 11-12). 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 brown creeper 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.

Prey abundance across the Forest is expected to increase substantially under the beetle outbreak. There should also be a sharp increase in nesting habitat across the Forest caused by the sharp increase in snags and trees with loose bark. This improved habitat will last as long as the beetle outbreak continues. When beetles decline again to endemic levels, the brown creeper density across the Forest will have a corresponding decline to normally expected level. Most beetle-killed trees from the next few years are likely to be still available as suitable nesting sites for several years. Overall, Forestwide nesting habitat quality is expected to increase through time under the beetle outbreak. The quantity of habitat will be dictated by how widespread the beetle outbreak becomes.

Catastrophic fire events from increased fuel loads within beetle-killed stands across the Forest would also affect brown creeper habitat. Widespread and intense wildfire across large areas of the landscape would eliminate brown creeper habitat for many decades. Approximately 100 years would be required for lodgepole stands to regrow and provide mature forest for foraging and trees or snags with loose bark for nesting.

The final extent of changes to brown creeper habitat from pine beetles or potential wildfires across the Forest is unknown. Surveys indicate that 75,000 acres had already been affected by beetle-kill by 2006. Much of this is comprised of large lodgepole trees potentially used for nesting and foraging. These acres would remain as nesting and foraging habitat under no action but the quality of this habitat would improve as long as standing dead trees and their limbs provide some cover. Brown

creeper density in beetle-infested areas would be higher than in the surrounding forest. Brown creeper density would be expected to continue to be elevated as long as the beetle population continued beyond endemic levels as has been found in other forests (Martin et al. 2006). This habitat would only become unsuitable when snags have fallen and younger regeneration dominates the affected sites after several decades.

Some timber harvest is occurring or is planned to occur across the Forest. Harvest among the Ryan Park-Tenmile, Box Canyon, Singer Peak, Blackhall/McAnulty, Cottonwood Rim, Soldier Summit, Silver Run, White Rock Estates, French Creek, Devil's Gate projects and the proposed Spruce Gulch project will remove approximately 6000 acres of habitat across the Forest. This is only 2% of the more than 300,000 acres of potential habitat available 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 in approximately 100 years.

Some timber harvest occurred on state lands across the Forest. The state of Wyoming completed 380 acres of harvest and 5.2 miles of road construction among Billie Creek, Dudley Creek, and Damfino Creeks. All clearcuts these areas, 350 acres, are assumed to be suitable as brown creeper habitat. The 350 acres of harvest will temporarily eliminate these stands as brown creeper habitat. These stands will not be available as foraging habitat as regeneration occurs because state lands have no requirements to retain live trees, snags, or coarse woody debris that provide structural features to prey habitat. Nesting habitat will be lost for about 100 years until sufficient regeneration occurs and appropriate cavity nests are available.

In total, there will be an increase in nesting habitat quality and an increase in foraging habitat quality and quantity across the Forest, even accounting for recent and proposed harvest. The beetle outbreak is becoming so large in creating or improving brown creeper habitat that any habitat losses to harvest are insignificant. The brown creeper population across the Forest probably will increase in response to the beetle outbreak (see Martin et al. 2006). The increase will last as long as the beetle outbreak then decline to normal levels.

Overall, proposed and on-going actions will retain more than 275,000 acres of suitable nesting and foraging habitat on the Forest. This amount is increasing with the beetle outbreak. Raphael (1987) indicated that brown creepers are found at densities near 20 acres/pair. Proposed and on-going actions (18,699 acres) could temporarily eliminate the equivalent of 900 home ranges on the Forest. However, harvest is distributed widely across the Forest in small strips around admin features, the beetle outbreak is creating more brown creeper habitat, and brown creeper density is expected to increase as habitat quality increases. So, the effect will likely be that any brown creepers that lose territory to harvest will gain suitable habitat in adjacent areas away from admin features. Habitat changes from harvest, beetles, and forest regeneration over time will ensure a continuing supply prey and future nesting habitat and will contribute toward maintaining the brown creeper population on the Forest.

Summary

Point count surveys for birds were completed in 2003 through 2007 using Rocky Mountain Bird Observatory (RMBO) protocol. Management Indicator, Sensitive species, and species of local concern were among species monitored with this protocol. Population trend results are available within Monitoring Wyoming's Birds (MWB)(Faulkner and Giroir 2003, 2004, and Lukacs 2005, WYNDD 2007). Monitoring Wyoming's Birds is a joint effort among Partner's in Flight Wyoming, Wyoming Natural Diversity Database, the WGFD, federal land management agencies in Wyoming (including the Medicine Bow National Forest), and RMBO.

Across the Forest, there are more than 300,000 acres of possible brown creeper nesting habitat distributed among the 4 mountain ranges (USDA 2003, p. 3-98, 123). The analysis of habitat changes for the 2003 Forest Plan revision indicated that mature lodgepole habitat changed less than 5% between 1985 and 2003 and indicated that mature spruce-fir decreased by less than 1% during the same period. The proposed action regenerates 6% of the forestwide habitat for approximately 100 years. The Forest Plan also has an objective (p. 1-4) to maintain or improve habitat across the Forest for species of local concern in the long term. The 50 to 100-year loss of 6% brown creeper habitat caused by this project is well within the range of natural changes that are expected to result from natural disturbances across the Forest in the long term. Indeed, it is possible that 133,177 acres across the Forest will regenerate over the next 50 years due to natural processes (USDA 2003, p. 3-113, Table 3-31). This Forest is naturally shaped by a "characteristic" disturbance regime that is not always consistent or predictable (USDA 2003, p. D-85). Even forested vegetation types, which are comparatively slower growing than other vegetation types on the Forest, provide a changing variety of habitats for wildlife that are highly variable in their persistence (USDA 2003, p. D-43, Table D-18). Continued maturing and the regeneration of existing stands are necessary to maintain suitable habitat across the Forest in the long term. Therefore, vegetation is being maintained to provide suitable habitat for brown creepers.

Brown creeper became a species of local concern with the Forest Plan revision completed December 2003. Population data collected to date is provided in Table 2. Brown creepers are difficult to detect due to their inconspicuous nature. They are sufficiently uncommon that only 3 have been detected on any of the 6 BBS routes on or adjacent to the Forest since the 1st route was surveyed in 1968. . Therefore, survey design within the RMBO songbird protocol was specifically adjusted in 2003 to account for birds such as the brown creeper. Results from 2003 and 2004 are a combination of RMBO survey protocol transects and opportunistic observations. After 2004, survey transects were standardized for monitoring across the Forest.

Annual fluctuations are typical for songbirds, which can vary considerably in response to annual climate variation. These results are consistent with habitat analysis and indicate that the brown creeper population remains viable across the Forest.

Table 2. Brown creeper monitoring across the Forest.

YEAR	# Observed
2003	24
2004	45
2005	47
2006	59
2007	24

Habitat will remain across the Forest for the Brown creeper population based on the following additional reasons:

- Forest management is regenerating 6% of Forestwide habitat
- Forest Plan standards for recruitment trees, snags and coarse woody debris are included in timber harvest, providing nesting and prey habitat.
- Forest Plan guideline to consult Partners-in-Flight Conservation Plans (p. 1-40) for additional guidance was accomplished. Brown creeper is a Level II priority species.
- The proposed activities are consistent with the revised Forest Plan (2003).

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). The National Forest Management Act (NFMA) requires that MIS be selected as part of the forest plan to estimate the effects of planning alternatives on fish and wildlife populations (USDA 2003). So, MIS are used as barometers to evaluate the effects of Forest management on wildlife within the Forest.

All MIS selected in the 2003 Revision of the *Medicine Bow National Forest Land and Resource Management Plan* were chosen for their ability to "resolve uncertainty about management effects" with "an emphasis on management issues," particularly those "identified as 'major'" (USDA 2003, p. H-2). As such, in selection as an MIS for the 2003 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, pers. comm.).

The Medicine Bow Forest Plan (USDA 2003) requires that data be collected annually and reported every 5 years using Class B or better surveys (p. 4-17). Class B methods are based on project records, communication, on-site ocular estimates, or less formal measurements like paced transects, informal visitor surveys, air photo interpretation, or other similar types of assessments. Reliability, accuracy, and precision are good but less than Class A. Class B methods are often qualitative but still provide valuable information on the status of the resource (p. 4-7). Class A surveys, though acceptable, are not required.

Wildlife Surveys

Surveys for northern goshawks are conducted annually across the Forest. Annual monitoring of nests has occurred since the initiation of a goshawk research project on the District in 1992.

Point count surveys for birds were completed since 2002 using Rocky Mountain Bird Observatory (RMBO) protocol. Management Indicator Species and Region 2 Sensitive species were among species monitored with this protocol. Population trend results are available within Monitoring Wyoming's Birds (MWB)(Faulkner and Giroir 2003, 2004, Lukacs 2005, and WYNDD 2007). Monitoring Wyoming's Birds is a joint effort among Partner's in Flight Wyoming, Wyoming Natural Diversity Database, the WGFD, federal land management agencies in Wyoming (including the Medicine Bow National Forest), and RMBO.

Pellet count surveys for MIS monitoring of snowshoe hares (similar to Miller 2004) were conducted across the Forest within suitable habitat since 2004.

Hair trap surveys for MIS monitoring of American marten (based on Belant 2003) were conducted across the Medicine Bow within suitable habitat during 2004 and 2005.

District records, WGFD records (Cerovski et al. 2004), and Wyoming Natural Diversity Database records (WyNDD 2005) were reviewed for additional observations and surveys of wildlife species.

Summary

The proposed action and no action will provide habitat for MIS. Proposed actions must follow Forest Plan (2003) standards and guidelines for water and aquatics, biological diversity, wildlife, and threatened, endangered and sensitive species (see USDA 2003). 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".

Identification of MIS related to the Proposed Action

The Medicine Bow Plan identifies 7 terrestrial wildlife MIS (Table 3). MIS in the Medicine Bow Plan will be evaluated for further analysis. Rationale for use as an MIS at the Forest level and habitat used is included in Table 3 and was taken from the FEIS for the Plan. MIS with no habitat in the analysis area need no further analysis because the project will not impact them, their habitat, or their Forestwide population trends. Amphibian and fish MIS are addressed in the aquatic resources MIS report.

Table 3. Management Indicator Species from the Medicine Bow Forest Plan and their associated habitats.

Species	**Indicator of:**	**Habitat Used**	**Habitat in the Analysis Area**
Snowshoe hare *Lepus Americana*	Adequacy of habitat to support prey species of top predators	Habitats with dense understory	Y
American marten *Martes Amercana*	Spatial pattern or fragmentation-perforation at landscape scale and coarse woody debris	SF,LPP	Y
Northern goshawk *Accipiter gentiles*	Late seral lodgepole and aspen	AS,LPP	Y
Golden-crowned kinglet *Regulus satrapa*	Fragmentation within a stand	SF, LPP	Y
Three-toed woodpecker *Picoides tridactylus*	Snags, old forest, recent forest burns	SF, LPP	Y
Lincoln's sparrow *Melospiza lincolnii*	Riparian zone, herbivory in willow community	RIP	Y
Wilson's warbler *Wilsonia pusilla*	Riparian zone, herbivory in willow community	RIP	Y
Common trout	Water quality	Addressed by Fisheries Biologist	

**AL-alpine, AS-aspen, FM-forest meadow, LPP-lodgepole pine, SS-sagebrush shrub, MS-mountain shrub, PP-ponderosa pine, RIP-riparian, RO-rock/cliff/cave, SF-spruce-fir, WET-wetland, PJ-Pinyon-Juniper*

Proposed actions include timber harvest within lodgepole forest within 150 ft of open roads, trails, and administrative sites (collectively called admin sites). No proposed actions will occur in willow riparian areas or affect herbivory in the willow community, for which Lincoln's sparrow and Wilson's warbler are MIS. In fact, proposed actions include several design criteria that prohibit mechanical equipment in riparian areas. The proposed actions will not occur within Lincoln's sparrow or Wilson's warbler habitat or affect the Lincoln's sparrow or Wilson's warbler or their habitat. Therefore, no further analysis is necessary for these MIS.

The project will affect habitat for snowshoe hares and the project occurs in lynx habitat. Lynx is a predator of snowshoe hares. Consultation with the US Fish and Wildlife Service is in progress for lynx and the project was determined to "may affect, not likely to adversely affect" Canada lynx.

The proposed action will affect habitat for American martens. The proposed action will have little effect spatial pattern or fragmentation-perforation at the landscape scale, however, for which marten was selected as a MIS.

The proposed action will affect habitat for the northern goshawk, specifically harvest in late seral lodgepole used as nesting habitat. Therefore, the proposed action will affect the issue for which goshawk was selected as an MIS.

The proposed action will affect stands of mature and older lodgepole used by golden-crowned kinglets. Proposed harvest could reduce canopy cover within stands, the issue for which golden-crowned kinglet was selected as a MIS.

The proposed action will affect mature and lodgepole used by three-toed woodpeckers. Proposed harvest could affect snags and old forest, issues for which three-toed woodpecker was selected as a MIS.

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 (review Tables 3 and 4). 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 snowshoe hare, American marten, northern goshawk, golden-crowned kinglet, and three-toed woodpecker.

Table 4. Summary of initial MIS analysis and identification of species for comprehensive population analysis.

Common Name of MIS	Management Issue/Habitat Assemblage	Species/ Habitat Present in Analysis Area?	Management Issue or habitat assemblage pertinent to the project?	Rationale	Species Selected for more detailed analysis?
Snowshoe hare	Adequacy of habitat to support prey species of top predators	**Yes**	**Yes.** The decision will affect habitat used by the species.	Effects of harvest to species and habitat should be analyzed.	**Yes**
American marten	Spatial pattern or fragmentation-perforation at landscape scale and coarse woody debris	**Yes**	**Yes.** The decision could affect fragmentation-perforation at the landscape scale and coarse woody debris	Effects of harvest to species and habitat should be analyzed.	**Yes**
Northern goshawk	Condition and biodiversity of late seral lodgepole and aspen	**Yes**	**Yes.** The decision will affect late seral lodgepole.	Effects of harvest to species and habitat should be analyzed.	**Yes**
Golden-crowned kinglet	Fragmentation within a stand	**Yes**	**Yes.** The decision could affect canopy cover within a stand.	Effects of harvest to species and habitat should be analyzed.	**Yes**
Three-toed woodpecker	Snags, old forest, recent forest burns	**Yes**	**Yes.** The decision could affect old forest and could affect snags.	Effects of harvest to species and habitat should be analyzed.	**Yes**
Lincoln's sparrow	Riparian zone, herbivory in willow community	**Yes**	**No.** The decision will not affect willow riparian zone or herbivory in willow community.	The issue or habitat assemblage that the species inidcates is not affected by the project. Forestwide monitoring data available in Forest's stopgap report.	**No**
Wilson's warbler	Riparian zone, herbivory in willow community	**Yes**	**No.** The decision will not affect willow riparian zone or herbivory in willow community.	The issue or habitat assemblage that the species inidcates is not affected by the project. Forestwide monitoring data available in Forest's stopgap report.	**No**
Common trout	Water quality	**Addressed in Fisheries biologist report**			

Medicine Bow Plan

Snowshoe hare

Life History and habitat requirements

Life history information about snowshoe hares is available from USDA (2004b) and Miller (2004). The snowshoe hare occurs within an altitudinal range of approximately 2,440 to 3,350 meters (8000 to 10,990 ft) (Armstrong 1972). Habitats that provide forage and cover needs of snowshoe hare include stands of relatively taller vegetation with a dense, multi-layered understory that maximizes cover and browse at both ground level and at varying snow depths throughout the winter (stems and branches from one to three meters above the ground). These habitats include spruce/fir, lodgepole,

and some aspen stands in the analysis area. In addition, snowshoe hares have been found to use willow riparian areas, especially during summer (Wolff 1980, Beauvais 1997, Ruediger et al. 2000). Relative to this project, proposed harvest can impact spruce/fir and lodgepole areas used by snowshoe hares. The snowshoe hare is a MIS for the Medicine Bow Plan addressing the issue of providing adequate prey for sensitive and threatened forest predators.

Available habitat

Across the Forest, there are 678,102 acres of snowshoe hare habitat (USDA 2003, p. 3-123). The proposed action includes harvest in lodgepole and no action includes beetle-caused loss in this habitat. Therefore, the snowshoe hare habitat pertinent to this project and the analysis area are the 9523 acres of lodgepole proposed for harvest or the lodgepole habitat that would be affected by pine beetles under no action.

Population information

Both peak and low densities of snowshoe hares have been shown to be lower in southern montane and sub-boreal forests than in northern boreal forests. In the southern regions of snowshoe hare range (which includes the Medicine Bow-Routt National Forest), peak densities are commonly 1-2 hares/ha, compared to northern populations with peak densities of up to 4-6 hares/ha (Hodges 2000). Snowshoe hares are found in most mountain ranges throughout Wyoming. Snowshoe hares are classified as a common resident, as a small game animal by the WGFD, and as occurring in 16 out of 28 mapped latilongs, (Cerovski et al 2004).

The snowshoe hare became a MIS with the Forest Plan revision completed in December 2003. Population trend data is available from pellet plots monitored across the Forest since 2004. Since 2005 samples were stratified across habitat types on the Forest. Data collected to date is provided in Table 5. Table 5 illustrates that snowshoe hares are found in relative abundance on the Medicine Bow and are well distributed across the Forest.

Table 5. Mean fecal pellets/sample plot of lagomorphs on the Medicine Bow NF by year.

	2005* within	2005 above	2006	2007	2008	2009	2010	2011
Total Lagomorph	9.33	5.99	3.96	3.52				

*Subplots had not been cleared in the previous year; pellets may have been accumulating more than a year. Values are not comparable to later years. For this year only, two values are given, for pellets above the duff, and pellets within the duff.

Conclusions:

Based on pellet group sampling and the 670,000 acres of available habitat, it is anticipated that, overall, snowshoe hares are common and well distributed across the Medicine Bow. Together, this animal's biology and existing habitat conditions suggests that snowshoe hares have a population trend that is currently no worse than stable on the Medicine Bow National Forest. However, conclusions about the Medicine Bow snowshoe hare population trend should be more definitive when the Forest Plan's 5-year monitoring report is available.

NO ACTION (No harvest) –**ANALYSIS OF LIKELY EFFECTS TO THE SNOWSHOE HARE**

Generally, mature forest will change to more open canopy cover and to an earlier structural stage. These changes would be the result of extensive loss of large lodgepole trees to beetles. There will be a corresponding increase in snags and a later increase in coarse woody debris.

The existing forest and the mature forest changed by normal beetle levels (no action) both provide habitat for snowshoe hares. However, where beetle-kill is widespread and complete, snowshoe hare

habitat will be temporarily lost. So much tree cover at ground level would be lost due to beetle kill that many of these stands would not provide sufficient hiding cover for hares. Remaining younger trees would be too widely spaced to provide effective cover. Habitat quality will improve within 40 years as lodgepole regeneration begins to provide year-round cover for hares.

The increase in coarse woody debris would increase the amount of hiding cover at ground level, useful during summer. But there would be no immediate increase in forage and no cover above the snow in winter. So, individuals might experience fewer predation attempts in summer but hare density will not increase. A hare that lives a few days or even weeks longer due to better summer cover will not increase the hare population.

Species generally require a greater area to forage and survive when habitat quality is reduced. The loss of overhead cover reduces habitat quality for hares. Thus, there may be a decrease in the density of snowshoe hares in beetle-killed stands across the Forest. This effect will decrease over 40 years as young tree density increases.

Dolbeer and Clark (1975) found densities of approximately 4 acres/hare (or 8 acres/breeding pair). The potential loss of thousands of acres over 40 years could result in a decrease in the total number of hares in lodgepole habitat on the Forest for that time. Still, this would be a very small change forestwide since spruce-fir is much better hare habitat on the Forest, pine beetles are not expected to affect spruce-fir stands, and beetles will not kill all lodgepole stands at one time. The potential snowshoe hare population change is well within the range of change that occurs naturally.

The Forest Plan has relevant objectives (p. 1-4) to maintain or improve habitat across the Forest for MIS in the long term and for moving terrestrial, aquatic, and riparian area composition, structure, patterns, and processes toward conditions typical of those created by natural processes. No action in the analysis area would, of course, allow the natural process of beetle outbreaks to occur. Forest Plan (USDA 2003) standards and guidelines for MIS and habitat that relate to the interaction of beetles, habitat, and wildlife will be met.

Cumulative effects for No Action

Some timber harvest is occurring or is planned to occur across the Forest. Harvest among the Ryan Park-Tenmile, Box Canyon, Singer Peak, Blackhall/McAnulty, Cottonwood Rim, Soldier Summit, Silver Run, White Rock Estates, French Creek, Devil's Gate projects and the proposed Spruce Gulch project will remove approximately 6000 acres of habitat across the Forest. This is <1% of the more than 670,000 acres of habitat available across the Forest. These acres would retain snags, recruitment trees, and coarse woody debris to provide some habitat characteristics when regeneration again provides foraging opportunity.

Some timber harvest occurred on state lands across the Forest. The state of Wyoming completed 380 acres of harvest and 5.2 miles of road construction among Billie Creek, Dudley Creek, and Damfino Creeks. All clearcuts these areas, 350 acres, are assumed to be suitable habitat. The 350 acres of harvest will temporarily eliminate these stands as habitat.

Overall, natural and man-made activities across the Forest are regenerating about 14% of habitat on the Forest over the next several years; overwhelmingly due to the beetle outbreak. This represents a modest change and might reflect a small change in the hare population forestwide. However, most hare habitat quantity and quality is in spruce-fir and pine beetles are not expected to change this habitat. This level of change is well within habitat and hare population changes expected to occur naturally. Hares would remain sufficiently abundant to provide a constant supply of prey to the Forest's predators; which is the reason hare was selected as a MIS for the Forest.

PROPOSED ACTION – ANALYSIS OF LIKELY EFFECTS ON THE SNOWSHOE HARE

There are currently more than 670,000 acres of hare habitat across the Forest. Proposed harvest in lodgepole stands would regenerate 12,699 acres of beetle-killed habitat near admin features across the Forest over 10 years. Most of these acres would already be unsuitable as hare 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 range of HRV; so, they will provide habitat features of cover and forage for the MIS snowshoe hare. These areas will regenerate to useful as year-round habitat within 40 years.

Individual hares probably would not be displaced from the harvest units by mechanical activity. Changes due to beetle-kill will have already made many of these lodgepole stands unsuitable. Of the 31,335 acres proposed for treatment, only 4355 (14%) contain enough spruce-fir cover (≥10%) to retain at least summer habitat characteristics. Individuals in the stands with ≥10% spruce-fir would move to unoccupied habitats or be taken through predation. Dolbeer and Clark (1975) found densities of approximately 4 acres/hare (or 8 acres/breeding pair). The loss of 4355 acres for up to 40 years could result in 1088 (0.6% of Forestwide population) fewer hares across the Forest for that time. This is an immeasurable change forestwide and well within the range of change that occurs naturally.

Forestwide habitat will not change noticeably under the proposed action. Only 1.8% (12,699 acres) of forestwide hare habitat will be temporarily lost either to beetle-kill or harvest. This amount of change is well within the range of natural changes to the Forest.

Overall, the proposed action will have a small, immeasurable effect on hare numbers across the Forestwide population. Any potential slight change in snowshoe hare density within the treated areas is not likely to be detected in forestwide surveys. The forestwide population trend for snowshoe hares should remain stable. The proposed action would continue to provide sufficient hares as prey for the Forest's predators; the reason it is a MIS.

The Forest Plan has relevant objectives (p. 1-4) to maintain or improve habitat across the Forest for MIS in the long term and for moving terrestrial, aquatic, and riparian area composition, structure, patterns, and processes toward conditions typical of those created by natural processes. Proposed action would maintain habitat across the Forest in the long term; only 1.8% will be temporarily lost. This amount of loss is expected to occur naturally. Indeed, the Forest Plan estimated that 52,000 acres would regenerate naturally over the next 50 years (USDA 2003, p. 3-113). Forest Plan standards and guidelines that relate to timber harvest will be met. Adhering to Forest Plan standards and guidelines (USDA 2003) will assist meeting the Plan objectives. For example, recruitment trees will be retained in harvest units, so that hare habitat is enhanced as it regenerates after harvest. The amount of recruitment trees is within HRV, so composition and structure would move toward conditions typical of those created by natural processes. Timber harvest that follows the Plan standards and guidelines will continue this movement toward "conditions typical of those created by natural processes".

Cumulative effects for the Proposed Action

Some timber harvest is occurring or is planned to occur across the Forest. Harvest among the Ryan Park-Tenmile, Box Canyon, Singer Peak, Blackhall/McAnulty, Cottonwood Rim, Soldier Summit, Silver Run, White Rock Estates, French Creek, Devil's Gate projects and the proposed Spruce Gulch project will remove approximately 6000 acres of habitat across the Forest. This is <1% of the more than 670,000 acres of habitat available across the Forest. These acres would retain snags, recruitment trees, and coarse woody debris to provide some habitat characteristics when regeneration again provides foraging opportunity.

Some timber harvest occurred on state lands across the Forest. The state of Wyoming completed 380 acres of harvest and 5.2 miles of road construction among Billie Creek, Dudley Creek, and Damfino Creeks. All clearcuts these areas, 350 acres, are assumed to be suitable habitat. The 350 acres of harvest will temporarily eliminate these stands as habitat.

Overall, natural and man-made activities across the Forest are regenerating about 14% of habitat on the Forest over the next several years; overwhelmingly due to the beetle outbreak. This represents a modest change and might reflect a small change in the hare population forestwide. However, most hare habitat quantity and quality is in spruce-fir and pine beetles are not expected to change this habitat. This level of change is well within habitat and hare population changes expected to occur naturally. Hares would remain sufficiently abundant to provide a constant supply of prey to the Forest's predators; which is the reason hare was selected as a MIS for the Forest.

American Marten

Life History and habitat requirements (from USDA 2003, App. I)

Martens are primarily animals of dense, old forest with a complex structure of understory and downed wood. Late-successional multi-storied stands of spruce-fir forest are preferred, though multistoried lodgepole (usually with invading subalpine fir) and other forest types with downed wood are also used. Martens are found in dense forest with canopy cover of at least 30%. A complex arrangement of downed wood (large logs, tangles of smaller material, root wads, downed trees with branches, and sloping logs and branches) provides habitat for prey, cover from predators, dens, resting sites, and entry to subnivian habitat. Squirrel middens, hollow logs, cavities in snags, and rock piles are used for dens. Partially arboreal, marten hunt and rest in trees, in cavities and on mistletoe brooms. Marten depend on old forest components like large snags and downed wood for maternal and natal dens. Though summer rest sites vary greatly, during winter, martens rest in large downed wood insulated by snow cover. The home range can have inclusions of mature forest and some openings as long as the old-forest features are abundant and well distributed.

Martens might also be affected by fragmentation (or perforation), not just habitat loss. Martens strongly avoided patch cuts (approximately 1 to 5 acres in size) in the Coon Creek study area on the Forest (USDA 2003). The few tracks detected in the cuts occurred only in the 1st or 2nd year following logging and hugged the edge. Potvin et al. (2000) found that martens were fairly intolerant of "habitat fragmentation" and cannot tolerate more than 30-35% cutovers in its home range. They stated that where the objective is to maintain marten habitat at a local scale, $\geq$ 50% uncut forest be preserved inside 10 km^2 (2471 acre) units and that < 30% of the area be clearcut over a 30-year period. Similarly, Chapin et al. (1998) found that martens tolerated a median of only 20% regenerating clearcuts in their home ranges. Bissonette et al. (1997) indicated that martens appear to avoid landscapes with more than 25% to 30% of the total area in vegetation types other than intact older forests. Finally, Hargis et al. (1999) reported that martens were absent from landscapes ($\geq$9 km^2) having >25% nonforested cover. Further, they found that forested landscapes appeared unsuitable for martens when the average distance between open patches was < 100m. This proximity of open areas in their study eliminated nearly all forest interior relative to martens.

However, more recent review (Fahrig 2003) suggests that past research actually evaluated only habitat loss and not the larger landscape-scale process involving both habitat loss and the breaking apart of habitat known as fragmentation. Fahrig (2003) stated that researchers did not measure the breaking apart of habitat, fragmentation, after controlling for habitat loss. Hargis et al. (1999) was one of the research projects evaluated in Fahrig (2003).

Furthermore, Potvin, Chapin, and Hargis, above, made evaluations at the scale of a marten home range. Mean home ranges for American martens in the Encampment River watershed of the Forest were found to be 1652 acres in summer and 1462 acres in winter for females and 4494 acres in summer and 3602 acres in winter for males (O'Doherty et al. 1997). Even Bissonette et al. (1997) related "fragmentation" to % loss of habitat at a landscape scale but did not evaluate landscape pattern while controlling for habitat loss. While all these researchers did find strong results related to habitat loss, they did not independently evaluate landscape scale fragmentation as pointed out by Fahrig (2003). Finally, Fahrig (2003) also concluded that the effects of habitat loss were much greater than the effects of fragmentation.

Regardless of this current debate among researchers on whether fragmentation is truly being measured as an independent effect in wildlife research studies, the Forest has experienced some habitat changes as a result of Forest management actions in the last 5 decades. Some type of timber harvest, and a supporting road network, has occurred over approximately 132,937 acres (12.3%, USDA 2003 p. 3-150) of the forested habitat across the Forest over 50 years. From this standpoint, it appears there has been a small amount of "fragmentation" of marten habitat.

Relative to this project, proposed action can impact lodgepole areas used by martens and the amount of habitat affected within home ranges. The American marten is a MIS for the Medicine Bow Plan addressing the issues of spatial pattern/fragmentation-perforation at the landscape scale, old growth and dead down wood.

Available habitat

Potential marten habitat across the Forest corresponds to spruce-fir forest of structural stages 4A through 4C and 5 and lodgepole of stages 4B, 4C, and 5 with some structural complexity. There are currently more than 246,000 acres of habitat across the Forest. The proposed action includes harvest in lodgepole and no action includes pine beetle-caused loss in this habitat. Across the Forest, there are more than 246,000 acres of marten habitat distributed among the mountain ranges (USDA 2003, p. 3-98,123). The analysis of habitat changes for the 2003 Forest Plan revision indicated that mature lodgepole habitat changed less than 5% between 1985 and 2003 and indicated that mature spruce-fir decreased by less than 1% during the same period.

Population information

A recent analysis compiled by the USFS Rocky Mountain Regional Office listed pine marten abundance as uncommon, population trend in the region as unknown, distribution in the region as patchy, and wide distribution outside of Region 2. They conclude that marten is widely distributed through the upper-elevation forests of Region 2 and is comparatively abundant at local scales where large amounts of quality habitat remain.

In Furbearers of Wyoming, Crowe (1986) suggested that marten populations, although prone to fluctuations, were secure throughout their range and were stable at the time. Martens are legally designated as furbearers in Wyoming with about 500 animals taken statewide each year (Wyoming Game and Fish Department 2001).

Extensive radio telemetry aided studies of American marten were conducted from 1985 through 1996 in the Coon Creek and East Fork Encampment River watersheds. Between 11 and 26 marten were trapped annually across two watersheds approximately 100 square miles in size (O'Doherty et al. 1997). A total of over 100 marten were eventually captured, radio-collared, released, and studied in the area.

O' Doherty et al. (1997) found that marten home ranges in the Encampment River watershed were much larger than other reported marten home ranges. Mean home ranges for martens in the Encampment River watershed on the Forest were found to be 1652 acres in summer and 1462 acres in winter for females and 4494 acres in summer and 3602 acres in winter for males. Female home ranges did overlap with male home ranges. Results of the study indicate that marten are widespread but uncommon on the Forest where suitable habitat is present.

Since martens are uncommon and have disproportionately very large home ranges, the Forest adopted a new survey technique in 2004 to monitor population trend. This hair snare technique is similar to the technique developed by Belant (2003). There are 62 hair snares; each monitoring the Forest for 11 to 14 days with 2 checks during this time. DNA from hair samples, and sometimes fecal samples, are used to determine individuals. Results for this Forestwide monitoring are provided in Table 6. On balance, all available data suggest that martens are well distributed within suitable habitat across the Forest. Forest-wide, the population appears stable but conclusions are tentative until the Forest Plan's 5 year monitoring is available. These results are consistent with habitat analysis and indicate that the marten population remains viable across the Forest.

Table 6. American marten Forestwide monitoring results.

YEAR	Total Marten samples	# New Individuals	# Previously Identified Individuals
2004	14	7	na
2005	31	15	3
2006	15	5	2

The American marten is a MIS under the Forest Plan revision completed in December 2003. Marten home range size requirements are disproportionately very large relative to body size, even compared to other carnivores (Buskirk and McDonald 1989 in Potvin et al. 2000).

Conclusions:

Based on WGFD harvest information, radio-telemetry results, the Forest's hair snare monitoring, and the more than 246,000 acres of available habitat, it is anticipated that, overall, martens are uncommon and well distributed across the Medicine Bow. Together, this animal's biology and existing habitat conditions suggests that martens have a population trend that is currently no worse than stable on the Medicine Bow National Forest. However, conclusions about the Medicine Bow marten population trend should be more definitive when the Forest Plan's 5-year monitoring report is available.

NO ACTION (No harvest) –**ANALYSIS OF LIKELY EFFECTS TO MARTEN**

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 marten habitat. No action could result in variable effects to American martens.

It is likely that martens use some habitat adjacent to the Forest's open roads, trails, and administrative sites (collectively admin sites). However, marten use could be reduced since research mentioned earlier (p. 11-12) indicated wildlife habitat quality and, relatedly, prey are reduced near roads. Ruggerio et al. (1994) indicated that forest carnivores such as American marten have forest patches with large core areas as important habitat features. Reed et al. (1996) studied the Tie Camp area immediately west of the Blackhall/McAnulty analysis area. They found that roads added to more to breaking apart forested patches than clearcuts by creating smaller patches, more patches, and converting interior habitat to edge habitat. So, usefulness of marten habitat near admin sites is reduced. There will be no change to the existing road network under no action.

Where pine beetles move through stands near admin features at normal levels, marten habitat quality would improve, although usefulness might not improved as described in the previous paragraph. There will be a beneficial mix of live and dead trees to support a variety of mammal and bird prey. These features will also retain some canopy cover and increase snags and coarse woody debris over time to improve marten habitat for foraging, denning, or resting. Drew (1995) found that martens foraged through areas of coniferous forest defoliated by spruce budworm and hemlock looper. In fact, these martens used defoliated stands more often than expected by simple random use. However, he also clarified this finding with "...while defoliated forest made up a significant portion of the home ranges of all but 1 marten in Newfoundland, the largest portion of all home ranges was intact mature and older coniferous forest".

Where pine beetle tree losses are nearly complete and widespread across many acres as it appears is currently occurring, marten habitat will be lost and then improve. The dramatic and relatively sudden decline in canopy cover should not provide enough overhead cover for martens (see Drew 1995 and USDA 2003 App. I). As cone resources decline over a decade, red squirrel prey will become scarce. Since these lodgepole stands generally lack much understory, the loss of overstory cover should also produce a decline in red-backed vole prey.

Over several decades, canopy cover will improve from regeneration and the growth of the small trees not affected by beetles. Snags and coarse woody debris will accumulate to provide resting and denning sites for martens. The increase of these features will also improve foraging habitat by providing an abundance of habitat for small mammals such as the red-backed vole. As lodgepole begin to produce cones again over the following 40 years, red squirrel habitat will improve again. In the long-term, Forestwide habitat quality is expected to increase through time under the beetle outbreak since over head cover is expected to eventually reoccur. The marten population across the Forest is expected to follow the changes in coarse woody debris accumulation and stand regeneration through time.

The final extent of changes to marten habitat from pine beetles across the Forest is unknown. Surveys indicate that 75,000 acres had already been affected by beetle-kill by 2006. Much of this is comprised of mature and older lodgepole stands potentially used by martens. These acres could remain as marten habitat unless change is severe and extensive across the landscape. Usually, beetle-infested areas would provide an accumulation of coarse woody debris to improve habitat quality in time. Marten density in beetle-infested areas would be higher than in the surrounding forest in time. Marten density would be expected to continue to be higher as long as some overhead cover existed, and snags and coarse woody debris was abundant.

Overall, no action could allow the maturing of forested habitat with increases in spruce-fir habitat through succession. These actions could increase marten habitat. Some important components of marten habitat, snags and coarse woody debris, would be increased by a combination of lower-level insect outbreaks, tree pathogens, and wildfires. However, this combination of events can also greatly reduce the live mature forest, potentially reducing marten habitat if these natural events, particularly beetles in this case, are widespread and complete. Growth of the existing understory of spruce-fir would reproduce marten habitat, mature spruce-fir and lodgepole with vertical structure, in 50 - 100 years if these events are widespread.

This possible considerable temporary loss of lodgepole in marten home ranges would reflect the corresponding loss of lodgepole old forest to beetles across the Forest. Monitoring of old growth forest is one of the reasons marten was selected as a MIS for the Forest Plan.

Marten was also selected as a MIS to monitor coarse woody debris and fragmentation - perforation. Fragmentation - perforation is addressed in cumulative effects. Coarse woody debris will greatly

accumulate over time but potentially at the expense of mature forest. So, there could be an unexpected inverse relationship between the Forest producing more than adequate amounts of coarse woody debris across an area and potential short-term decline in martens in the same area. In the longer term, martens could positively respond to the woody debris accumulation as remaining forest vegetation matures to provide other marten habitat needs.

The Forest Plan has relevant objectives (p. 1-4) to maintain or improve habitat across the Forest for MIS in the long term and for moving terrestrial, aquatic, and riparian area composition, structure, patterns, and processes toward conditions typical of those created by natural processes. No action in the analysis area would, of course, allow the natural process of beetle outbreaks to occur in lodgepole on the Forest. Marten habitat would return within 50 – 100 years depending on the growth rate of remaining understory trees and completeness of the outbreak. In fact, the accumulation of coarse woody debris over time could improve marten habitat quality by providing an abundance of resting and denning sites over decades. So, no action would provide marten habitat in the long term. Forest Plan standards and guidelines (USDA 2003) for MIS and habitat that relate to the interaction of beetles, habitat, and wildlife will be met.

Cumulative effects for No Action

Habitat immediately adjacent to the current road system provides reduced quantity and quality habitat to wildlife (see p. 11-12). Some research has found, for example, that edge effects of roads extend 50m into the forested habitat (Tinker et al. 1998). Snags, coarse woody debris, and prey could become more abundant next to roads. But the fewer core areas (Ruggerio et al. 1994), abundant vehicle and visitor disturbance, firewood cutting and extensive overstory cover change could discourage marten use. There are still several hundred thousands of acres of habitat across the Forest away from roads.

Some timber harvest is occurring or is planned to occur across the Forest. Harvest among the Ryan Park-Tenmile, Box Canyon, Singer Peak, Blackhall/McAnulty, Cottonwood Rim, Soldier Summit, Silver Run, White Rock Estates, French Creek, Devil's Gate projects and the proposed Spruce Gulch project will remove approximately 6000 acres of habitat across the Forest. This is <2.5% of the more than 246,000 acres of potential habitat available across the Forest. These acres would retain snags, recruitment trees, and coarse woody debris to provide some future foraging opportunity. These stands will regenerate to provide characteristics of foraging habitat within 50 years and the large trees, snags, and coarse woody debris useful as marten denning habitat within another 50 years.

Some timber harvest occurred on state lands across the Forest. The state of Wyoming completed 380 acres of harvest and 5.2 miles of road construction among Billie Creek, Dudley Creek, and Damfino Creeks. All clearcuts these areas, 350 acres, are assumed to be suitable as marten habitat. The 350 acres of harvest will temporarily eliminate these stands as marten habitat. These stands will be available later as foraging habitat as regeneration occurs but quality will be very low since state lands have no requirements to retain live trees, snags, or coarse woody debris that provide structural features to prey habitat. Denning habitat will be lost for about 100 years until sufficient regeneration occurs and appropriate snags and coarse woody debris are available.

Martens might also be affected by fragmentation (or perforation), not just habitat loss. The debate among researchers on whether marten research has only addressed habitat loss and not the larger landscape-scale process involving both habitat loss and the breaking apart of habitat (fragmentation) is addressed under *Life history and habitat requirements* for martens. That information is not repeated here.

Regardless of this debate, these researchers have shown that martens do not use home ranges that had ≥25% nonforested cover, including clearcuts ≤30 years old (see Potvin et al. (2000), Chapin et al.

(1998), Hargis et al. (1999)). The Forest has experienced some habitat changes as a result of Forest management actions in the last 5 decades. Some type of timber harvest, and a supporting road network, has occurred over approximately 132,937 acres (12.3%, USDA 2003 p. 3-150) of the forested habitat across the Forest over 50 years. From this standpoint, it appears there has been a small amount of "fragmentation" of marten habitat.

Interior forest is an important component of marten habitat (USDA 2003, p. I-130) and also is relevant to fragmentation. Indeed, Baker and Kipfmueller (2001) indicated that some aspects of the fragmented spatial pattern created by harvest and roads could be offset by maintaining large patches of old forest, among other suggestions. One index to interior forest that was evaluated in the recent Forest planning process is security areas; those areas ≥ ½ mile from a road and containing 250 acre blocks of forested habitat with moderate to high canopy cover. So, security areas can provide large expanses of forested cover and low road density for martens. Geographic Areas across the Forest average 20% security habitat. As much as this interior forest index relates to man-caused changes to marten habitat - harvest and supporting roads creating many smaller, younger, uniform size and shape vegetation patches - it appears that Forest management has already affected a considerable amount of potential marten habitat.

Under a potential complete and widespread pine beetle outbreak, these security areas might still be retained. The Forest Plan defined security areas to also include habitat structural stages 3B and 3C (USDA 2003, p. 3-262). While live tree cover will be lost, there would still be standing dead trees and small live trees that could provide cover in these blocks of interior forest. From the standpoint of security habitat then, "fragmentation" will not increase under no action.

An extensive road network contributes to fragmentation characteristics of high edge contrast, smaller patch size, and less interior forest. Hargis et al. (1999) did report that forested landscapes appeared unsuitable for martens when the average distance between open patches was < 100m. However, their open patches were defined by clearcut harvest. Likewise, other marten research has evaluated habitat changes for martens relative to harvest, not roads. Martens might use heavily roaded areas less due to the amount of open patches, similar to harvest created openings, but the exact effect of this habitat change to martens is not known.

The more than 246,800 acres of marten habitat across the Forest might accommodate as many as 204 marten home ranges, 149 female ranges overlapping with 55 male ranges based on O'Doherty et al. (1997). On-going and future actions among the Ryan Park-Tenmile, Box Canyon, Singer Peak, Blackhall/McAnulty, Cottonwood Rim, Soldier Summit, Silver Run, White Rock Estates, French Creek, Devil's Gate and Spruce Gulch projects will retain more than 240,000 acres (98%) of the marten habitat across the Forest. Potvin et al. (2000) and Hargis et al. (1999) found that martens occupied home ranges until 25% to 35% of the home range became nonforested. The cumulative effect of habitat loss and the distribution of this habitat loss could have caused 12 marten home ranges to be temporarily unoccupied across the Forest; or martens in these home ranges adapted by expanding or shifting their home ranges. Past, on-going, and future actions for 30 years would create more than 25% nonforested habitat ("fragmented" habitat) within the 12 home ranges. These potential population effects are small in scale and over time in comparison to marten habitat across the Forest. These potential population effects are small compared to the potential habitat changes from any past or the current pine beetle outbreak. Finally, most marten habitat occurs in mature and older spruce-fir; lodgepole is generally less used. Thus, changes caused by Forest management should retain a stable marten population across the Forest.

Fragmentation – perforation will decrease under no action considering other vegetation characteristics as well. No action would cause many small patches of various ages to become fewer but larger patches representing younger age classes. Edges would have low contrast and irregular shapes due to

the variability in beetle mortality. This would be at the expense of older forest, which is marten habitat, of course.

Marten is a MIS for fragmentation-perforation at the landscape scale for the Forest Plan. Fragmentation-perforation will greatly decrease but at the expense of mature forest. So, there could be an unexpected inverse relationship between the Forest changing to fewer, larger, less uniform shaped vegetation patches across an area and potential short-term decline in martens in the same area. In the longer term, martens could positively respond to the creation of these larger maturing forested stands.

Overall, natural and man-made activities across the Forest are regenerating about 30% of habitat on the Forest over the next several years; overwhelmingly due to the beetle outbreak. Forest management is changing only 2% of this habitat. These represent a modest change and might reflect a change in the marten forestwide. However, most marten habitat quantity and quality is in spruce-fir and pine beetles are not expected to change this habitat. This level of change is probably within HRV. Indeed, the Forest Plan estimated that 52,000 acres would regenerate naturally over the next 50 years (USDA 2003, p. 3-113). Dillon et al. (2003) indicated that periodic episodes of severe insect damage most likely will always be a part of Rocky Mountain forest dynamics and mortality caused by insects has probably been the second most important form of disturbance in high-elevation forests. Of course, the marten population on the Forest survived these episodes of severe insect damage in the past. The forestwide population trend for martens could remain stable (if beetle outbreak is less severe) or might indicate a decrease relevant to this alternative. Marten population change would reflect the loss of some old growth forest but could have an inverse response to the reduction in fragmentation and the increase in coarse woody debris; all issues for which marten was selected as a MIS.

PROPOSED ACTION (Harvest) –**ANALYSIS OF LIKELY EFFECTS TO MARTEN**

There are currently more than 246,000 acres of marten habitat across the Forest. Many potential marten home ranges on the Forest will not be affected since most of the lodgepole proposed for harvest is not suitable marten habitat. Proposed harvest in lodgepole stands would eliminate 1655 acres of marten habitat near admin features across the Forest over 10 years. These stands are adjacent to roads, so, their usefulness will be reduced as described earlier. These stands will be comprised of dead or dying lodgepole. So, their usefulness to martens will already be changing; being lost where beetle-kill is complete and widespread as discussed earlier. Forest plan standards for recruitment trees, snags and coarse woody debris will retain some habitat features to provide foraging habitat within 50 years and denning habitat within 100 years.

The 1655 acres of treatment in marten habitat are widely distributed across the Snowy Range and Sierra Madre Range. Treatment is scattered across several potential marten home ranges. Most affected marten home ranges will receive only a few acres of treatment within suitable habitat; no marten home range will receive more than 85 acres of treatment within suitable habitat. So, the direct loss of habitat from the proposed action is not going to cause any marten home range to become unoccupied.

Individual martens would be expected to leave the immediate area surrounding treatment units due to the noise disturbance caused by mechanical equipment during harvest. Immediately after harvest, habitat will not be suitable to martens, so martens will continue to avoid these areas. These are such small areas within marten habitat that fitness or survival of individual martens should not be affected.

Overall, the proposed actions will have a small effect on marten numbers across the analysis area and an immeasurable effect on the Forestwide population. Any slight change in marten density within the

analysis area is not likely to be detected in forestwide surveys. The forestwide population trend for martens should remain stable.

Marten was also selected as a MIS to monitor coarse woody debris and fragmentation - perforation. Fragmentation is addressed in cumulative effects. Coarse woody debris and snags will be retained in harvest units according to Forest Plan standards. So, the forestwide marten population would remain stable over time considering that adequate amounts of coarse woody debris are expected to be available through time. In the long term, martens should positively respond to the woody debris accumulation as previously harvested forest vegetation matures to provide other marten habitat needs.

The Forest Plan has relevant objectives (p. 1-4) to maintain or improve habitat across the Forest for MIS in the long term and for moving terrestrial, aquatic, and riparian area composition, structure, patterns, and processes toward conditions typical of those created by natural processes. Proposed action would maintain habitat across the Forest in the long term; only 0.7% will be temporarily lost. This amount of loss can be expected to occur naturally. Indeed, the Forest Plan estimated that 52,000 acres would regenerate naturally over the next 50 years (USDA 2003, p. 3-113). Forest Plan standards and guidelines that relate to timber harvest and roads will be met. Adhering to Forest Plan standards and guidelines (USDA 2003) will assist meeting the Plan objectives. For example, coarse woody debris will be retained in harvest units, so that marten habitat is either retained or returns more quickly after harvest. The amount of coarse woody debris is within HRV, so composition and structure would move toward conditions typical of those created by natural processes. Timber harvest that follows the Plan standards and guidelines will continue this movement toward "conditions typical of those created by natural processes".

Cumulative Effects of the Proposed Action

Habitat immediately adjacent to the current road system provides reduced quantity and quality habitat to wildlife (see p. 11-12). Some research has found, for example, that edge effects of roads extend 50m into the forested habitat (Tinker et al. 1998). Snags, coarse woody debris, and prey could become more abundant next to roads. But the fewer core areas (Ruggerio et al. 1994), abundant vehicle and visitor disturbance, firewood cutting and extensive overstory cover change could discourage marten use. There are still several hundred thousands of acres of habitat across the Forest away from roads.

Some timber harvest is occurring or is planned to occur across the Forest. Harvest among the Ryan Park-Tenmile, Box Canyon, Singer Peak, Blackhall/McAnulty, Cottonwood Rim, Soldier Summit, Silver Run, White Rock Estates, French Creek, Devil's Gate projects and the proposed Spruce Gulch project will remove approximately 6000 acres of habitat across the Forest. This is <2.5% of the more than 246,000 acres of potential habitat available across the Forest. These acres would retain snags, recruitment trees, and coarse woody debris to provide some future foraging opportunity. These stands will regenerate to provide characteristics of foraging habitat within 50 years and the large trees, snags, and coarse woody debris useful as marten denning habitat within another 50 years.

Some timber harvest occurred on state lands across the Forest. The state of Wyoming completed 380 acres of harvest and 5.2 miles of road construction among Billie Creek, Dudley Creek, and Damfino Creeks. All clearcuts these areas, 350 acres, are assumed to be suitable as marten habitat. The 350 acres of harvest will temporarily eliminate these stands as marten habitat. These stands will be available later as foraging habitat as regeneration occurs but quality will be very low since state lands have no requirements to retain live trees, snags, or coarse woody debris that provide structural features to prey habitat. Denning habitat will be lost for about 100 years until sufficient regeneration occurs and appropriate snags and coarse woody debris are available.

Potvin et al. (2000) and Hargis et al. (1999) found that martens occupied home ranges until 25% to 35% of the home range became nonforested. The cumulative effect of habitat loss and the distribution of this habitat loss from this proposal and other proposed and on-going actions could cause 12 marten home ranges to be temporarily unoccupied across the Forest; or martens in these home ranges adapted by expanding or shifting their home ranges. Past, on-going, and proposed actions for 30 years have created more than 25% nonforested habitat ("fragmented" habitat) within the 12 home ranges. The loss of these home ranges was caused by past and on-going actions; none were lost as a result of this proposed action. These potential population effects are small in scale and over time in comparison to marten habitat across the Forest. These potential population effects are small compared to the potential habitat changes from any past or the current pine beetle outbreak. Finally, most marten habitat occurs in mature and older spruce-fir; lodgepole is generally less used. Thus, changes caused by this Forest management should retain a stable marten population across the Forest.

Martens might also be affected by fragmentation (or perforation), not just habitat loss. The debate among researchers on whether marten research has only addressed habitat loss and not the larger landscape-scale process involving both habitat loss and the breaking apart of habitat (fragmentation) is addressed under *Life history and habitat requirements* for martens. That information is not repeated here.

Regardless of this debate, these researchers have shown that martens do not use home ranges that had >25% nonforested cover, including clearcuts <30 years old (see Potvin et al. (2000), Chapin et al. (1998), Hargis et al. (1999)). As discussed in a previous paragraph, past actions have caused the loss of 12 potential home ranges across the Forest but the addition of this proposed action does not cause any more potential home ranges to be lost.

The USDA (2003) identified 3 factors that generally reflect the level of fragmentation in the Forest: patch size, roads, and interior forest/edge relationships (p. 3-139, 245). These characteristics will be evaluated for the Hazard Tree proposed actions.

As mentioned earlier, security areas are an index to interior forest. Research suggests that interior forest can be important to martens (see Potvin, Chapin, Hargis above). The proposed action occurs along existing open roads and trails. No new roads will be constructed into the forest for this project. By definition, security areas are ≥ ½ mile from open roads. Security areas will not be affected by the proposed action. So, there will be no change to the interior forest used by martens. Most important to this point is that most marten habitat is mature and older spruce-fir which is not affected by this proposed action.

Past harvest has changed the size and shape of vegetation patches across the Forest. Some type of harvest has occurred across 12% of the Forest since 1951 (USDA 2003 p. 3-150). The result is that some areas across the Forest are comprised of more, smaller patches with more uniform and abrupt rectangular shapes than would occur naturally. Much of the proposed action occurs across patches that have been harvested in the past. Many of the roads were originally constructed to allow timber harvest, so, harvesting along these roads will consolidate some harvest units from the past. Age class will be similar since all dead and dying trees will be removed and beetles are killing most trees of medium and larger size.

Of course, these new patches will be larger and linear compared to the existing landscape. They will also create a sharp contrast to habitat more than 150 ft from roads. Forest Plan standards for snags, recruitment trees, and coarse woody debris will help reduce this contrast over time.

No new roads are proposed that would add to fragmentation. Existing fragmentation along open roads and motorized trails will be more pronounced since treatment occurs within 150 ft of either side of the road. But, there will be no new breaking apart of habitat pieces. It was already mentioned earlier that marten habitat next to open roads already has reduced quality due to disturbance, reduced prey, and reduced snags and coarse woody debris. So, there will be no increase in the fragmentation of marten habitat caused by roads. These harvested areas would return to foraging habitat in approximately 50 years and mature to provide denning habitat in another 50 years as forest structure matures and canopy cover increases.

Effects of fragmentation to martens also include increased home range size with consequent increases in energy expenditure for winter travel. The increased energy expenditure can reduce individual fitness. Continued reduced fitness can lead to potential reproduction impacts and, therefore, population impacts. Since less than 100 acres of treatment occurs within any potential home range, the proposed action is not expected to increase energy expenditure of individual martens enough to reduce individual fitness.

In total, there could be a reduction in habitat across the Forest from pine beetles and harvest. Harvested stands or stands after catastrophic wildfire would not be used for decades. Depending on the completeness of beetle-kill within stands and across the landscape, habitat may be enhanced or lost. However, since martens prefer spruce-fir, it is expected that only a small portion of any home range is probably comprised of mature lodgepole. So, any lost lodgepole is not likely to cause any territories to be lost. The marten population across the Forest probably won't change since most home ranges will occur in mature or older spruce-fir habitats and harvest and beetle outbreak are not changing this habitat.

Overall, activity on the Forest should decrease fragmentation of marten habitat. Proposed harvest will aggregate some patches, which Reed et al. (1996) identified as a fragmentation reducing recommendation from Ripple et al. (1991). Most proposed harvest units will increase patch size and decrease the number of patches over time. Reed et al. (1996) found fragmented forest had decreasing patch size and increased number of patches. Distinct edges will disappear over time, aided by Forest Plan requirements for recruitment trees, snags, and coarse woody debris in harvested stands. Distinct edges were a fragmentation concern identified by Reed et al. (1996), Reed et al. (1996a), and Baker and Kipfmueller (2001). Road density will not change with the proposed action. Reed et al. (1996a) and Tinker et al. (1998) concluded that roads had a greater effect on fragmentation than clearcuts. Baker and Kipfmueller (2001) also recommended road closures to reduce fragmentation. Baker and Kipfmueller (2001) recommended maintaining large patches of old forest. Wilderness, roadless areas, and security areas (>100,000 total acres) will maintain or promote large patches of old forest.

This proposal and other proposed and on-going actions will retain more than 238,000 acres (96%) of suitable marten habitat on the Forest. Overall, past, on-going, and proposed actions are temporarily eliminating 7655 acres (3.1%) of marten habitat across the Forest. This represents a small habitat change that is not likely to be detected in monitoring the marten population forestwide. Any change in marten density in specific areas caused by the proposed action would be too small to reflect a population change forestwide. This level of change is within habitat and marten population changes expected to occur naturally. Indeed, the Forest Plan estimated that 52,000 acres would regenerate naturally over the next 50 years (USDA 2003, p. 3-113). The population trend over time should appear stable relevant to the proposed action. Long-term marten population stability would reflect the very small change in forestwide old forest habitat (-3.1%), the local retention of coarse woody debris within HRV according to Forest Plan standards for harvest units, and reduced fragmentation in the long term. These are all reasons that marten was selected as a MIS on the Forest.

Northern Goshawk

Life History and habitat requirements

Life history information is available in Reynolds et al. (1992) and Kennedy (2003). Goshawk is a sensitive species in Region 2 and MIS on this Forest. Goshawk is highly associated with late seral lodgepole pine, mixed lodgepole/aspen, and aspen forest for nesting and is associated with a variety of age classes and shrub stands for prey species (Squires and Ruggiero 1996, Reynolds et al. 1992, Kennedy 2003).

Reynolds et al. (1992) identified 3 nested spatial scales to describe how breeding goshawks use southwestern landscapes: (1) a 25 to 30 ac nest area, comprised of 2-3 alternate nests within different stands in the nest area, (2) a 300 to 600 ac post-fledging area (PFA), which is an area surrounding the nest used by young for the time of fledging to independence from the adults and (3) a 3700 to 5200 ac foraging area where the breeding pair hunts for food. Reynolds et al. (1992) also noted that variability would occur among nesting pairs in the size of these areas. While the work of Reynolds et al. (1992), was targeted specifically to the southwestern landscape there has been general agreement among biologists that the above descriptions can be applied to the discussion of breeding goshawks elsewhere (Anderson et al. 2003).

The PFA typically includes a variety of forest types and conditions. It represents an area of concentrated use by the family from the time the young leave the nest until they are no longer dependent on the adults for food (up to two months). These areas are important for fledglings since they provide hiding cover and prey on which to develop hunting skills. PFAs have patches of dense trees, developed herbaceous and/or shrubby understories, and habitat attributes such as snags, downed logs, and small openings that provide necessary habitat for many goshawk prey species.

Depending on region, season, and availability, the goshawk captures a wide variety of prey and is classified as a prey generalist (Kennedy 2003). Foraging area goshawks do use late-successional forests for foraging, but also take prey associated with both early and late-successional forests, and in some cases, open habitats (Anderson et al. 2003). Goshawk diets consist 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, Squires 2000, Kennedy 2003). Insects, including grasshoppers and caterpillars, are also eaten (DeGraff *et al.* 1991). Squires' (2000), study of goshawk food habits in south central Wyoming (Medicine Bow National Forest), examined the contents of 793 regurgitated pellets collected from 40 active nests after the young had fledged. Based on percent occurrence of prey remains in those pellets the most dominant prey species were, red squirrels, northern flicker, American robin, and golden-mantled ground squirrel. Overall, Squires found more than 30 species in the goshawk diet.

The primary concern (or potentially limiting factor) for goshawk viability is habitat alteration due to timber harvest and fire management practices, particularly in relation to aspen retention (Kennedy 2003, USDA 2003, p. I-143). Squires in USDA (2004a) indicated nesting habitat is the most important component in the distribution and numbers of birds. The goshawk is a MIS for the Medicine Bow Plan to indicate the condition and biodiversity of late-seral lodgepole and aspen forests. The goshawk has the most diverse prey base of the top predators on the MBNF, and thus, if goshawk population trends are stable or increasing, then the habitat must be supporting adequate densities of some prey species (USDA 2003, p. H-13). Relative to this project, proposed harvest can impact mature and older lodgepole used by goshawk for nesting. Aspen habitat will not be affected by the proposed action.

Available habitat

Across the Forest, there are 203,800 acres of possible nesting habitat (USDA 2003, p. 3-123). The analysis of habitat changes for the 2003 Forest Plan revision indicated that mature lodgepole habitat changed less than 5% between 1985 and 2003 and indicated that mature aspen increased by approximately 10% during the same period. This habitat is well distributed across the Forest. The proposed action includes harvest in mature lodgepole and no action includes a beetle outbreak in mature lodgepole. No activity is proposed in mature aspen and the beetle outbreak will not affect mature aspen. There is a possibility that some aspen will regenerate after harvest but it will be a small amount and it is very unlikely that this aspen will live long enough to become nesting habitat. Therefore, the goshawk habitat pertinent to this project is the mature lodgepole proposed for harvest or affected by beetles.

Population information

The goshawk is holarctic in distribution and is globally secure (G5 ranking). In North America, it breeds primarily in forested habitat in Canada, Alaska, and the mountains of the western United States and Mexico. Goshawks also occur across northern Europe and Asia.

Several sources of information are available and useful for estimation current population status, trend, and abundance for goshawks on the Medicine Bow National Forest. These data reflect different landscape scales and include results that have been gathered over large geographic areas (*i.e.*, the southern Rocky Mountains) as well as locally. While none of these data are independently adequate to estimate goshawk population trend and abundance, and some information may even be contradictory, collectively the information affords a basis for making credible inferences about population trend and abundance for this species on the Forest.

In 1997, the USFWS received a petition to list the goshawk as threatened or endangered. The Service's subsequent analysis gathered information on occurrence across the country and found no evidence that the species was declining, that habitat was limiting, that there were significant areas of extirpation, or that habitat or range was being curtailed. The Service determined that listing under the Endangered Species Act was not warranted.

Kennedy (2003) concluded that there is no evidence to support conclusions as to whether the goshawk is either declining or increasing in North America. There are no long-term indices of trends or estimates of goshawk breeding population size derived from standardized, widespread surveys in North America, nor is there sufficient information available to make a status determination for the breeding range contained within the entirety of Region 2 (Kennedy 2003).

Goshawks are a Level I (need conservation action) species in the Wyoming Bird Conservation Plan (Nicholoff 2003) and Wyoming Natural Diversity Database (WYNDD) lists them as a Species of Concern (Keinath and Beauvais 2003). Wyoming Game and Fish (WGFD) listed this species as a common resident (NSS4) (Cerovski 2004). The Wyoming Natural Heritage Program has this species listed as an S3 species within the state (rare or local throughout its range or found locally in a restricted range vulnerable to extirpation), although it is considered demonstrably widespread or secure across the United States.

Sauer et al. (2004) have analyzed bird count data gathered between 1966 and 2004 from breeding bird transects across North America. The results of their analyses are available at the continental scale and at other geographic scales, as well. These data are available from the National Breeding Bird Survey (BBS). Population trend derived from these data implies an increasing trend within Wyoming (+14.4%/year) and a slightly increasing trend in the southern Rockies (0.5%/year), which includes the Medicine Bow-Routt National Forest. The difficulty of detecting goshawks using BBS methodology is quite high and the annual counts of the species over the 38-year sampling period are sporadic with

low annual observations. Consequently, available data for this species are 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 the detection of goshawks on some BBS routes, the estimated change is not significant (calculated p= 0.06 and 0.9, respectively from Sauer *et al.* 2004 estimating equation). However, this lack of statistical significance should not be interpreted to mean the trend is stable, but the test of significance indicates that the data thus far collected are inadequate to reject the null hypothesis (α=0.05) that the real trend is different from 0. BBS survey methodology is not considered adequate to sample this raptor because of the low survey counts of the species. Goshawks have only been observed in 2 years and in 3 years, respectively, on 2 different BBS routes on the Forest (Sauer et al. 2004).

The revised Forest Plan required (p. 4-17) that MIS data be collected annually and reported every 5 years using Class B surveys. Data collected to date is provided in Table 7. Annual surveys for over a decade suggest that the goshawk population trend appears to be stable across the Forest but conclusions are tentative until the Forest Plan's 5 year monitoring is available. Fluctuations exhibited in Table 15 can be related to observer effort and natural, yearly variation in climate and prey, consistent with habitat analysis. Overall, there has been territory occupancy has remained near 50% for the last 5 years.

The data presented in Table 7 represent annual monitoring of goshawk territories and their associated nests across the Forest. Annual monitoring has occurred since the initiation of a goshawk research project on the District in 1992. Goshawks appear to be relatively abundant on the MBNF. Goshawks are found well distributed across the forest and are regular breeding birds. There are more than 300 recorded nests on the MBNF. These include 268 historic/current known active or inactive nests on the Brush Creek Hayden District, including 39 active nests and 74 inactive nests found by Squires (1996), 17 known nests on the Laramie District, and 25 on the Laramie Peak Unit. Another 51 nest sites are known on land in other ownership within the National Forest boundary in the Laramie Peak Unit (USDA 2003, p. I-141).

Table 7. Territory Occupancy across the Medicine Bow National Forest

YEAR	# Territories Surveyed	# Territories Active	% Territories Active
1992	46	32	70
1993	21	4	19
1994	17	5	29
1995	5	2	40
1996	33	10	30
1997	42	13	31
1998	13	9	69
1999	26	4	15
2000	4	2	50
2001	9	4	44
2002	7	4	57
2003	11	6	54
2004	43	10	23
2005	31	8	26
2006	24	12	50

2007	24	11	46

Conclusions
USFS monitoring results since 1992, the known number of territories, and the 203,800 acres of available nesting habitat suggest the goshawk on the Forest is uncommon but well distributed. Together, this animal's biology and existing habitat conditions suggests that goshawks have a population trend that is currently no worse than stable on the Medicine Bow National Forest. However, conclusions about the Medicine Bow marten population trend should be more definitive when the Forest Plan's 5-year monitoring report is available.

NO ACTION (No harvest) –**ANALYSIS OF LIKELY EFFECTS TO GOSHAWK**

Direct Effects and Indirect Effects

There are 16 known goshawk nests within 13 territories near (within 150 ft) open roads/trails and administrative sites (collectively admin features) across the Forest. Most known goshawk nests across the Forest, more than 280, are not near these admin features. This coincides with research mentioned earlier (p. 8-9) that indicates habitat quality is reduced for many wildlife near roads.

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 also found, however, 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 could continue to nest in beetle-killed stands near these administrative features (roads/trails, administrative sites) until the nest trees and the stands deteriorate over 10 to 20 years. There will still be some of the canopy cover and interlocking limbs of nesting habitat but created by dead limbs. After 1 or 2 decades, 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. There should still be enough prey animals to support adults in the territories but, perhaps, not enough prey for successful nesting.

The possible temporary loss of goshawk nesting in some areas could reflect the corresponding loss of late seral lodgepole forest to beetles across the Forest. Monitoring of late seral lodgepole forest is one of the reasons goshawk was selected as a MIS for the Forest Plan. However, 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, suitable nesting stands that are lost won't all die at the same time, and some existing younger stands will mature to suitable nesting habitat over the next few decades.

Goshawk was also selected as a MIS to monitor the biodiversity of late seral lodgepole. Certainly, foraging habitat would change to beetle-killed stands being more common in local territories. Snags and coarse woody debris would be abundant. Goshawk diets could change somewhat and there could be a small decline in overall prey abundance with these habitat changes but prey would still be common. For example, diet could shift somewhat to fewer red squirrels and more woodpeckers as a result of less live tree canopy cover and cone production but more snags. Red squirrels typically exist at a higher density than woodpeckers. The change in prey consumption would reflect the change in abundance of several prey species in this portion of the Forest. In the longer term (≥40-80 years), goshawks could positively respond to the habitat changes as unaffected forest vegetation matures to provide nesting habitat while a high density of snags and coarse woody debris remain to provide a type of foraging habitat that is uncommon on the Forest (regenerating beetle-killed stands).

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. Even without beetle-killed stands, the Forest has occupied goshawk territories where successful nesting does not occur. Some territories with lodgepole nesting habitat probably won't be affected by beetles; some territories also have aspen nesting habitat. A few territories might be abandoned if sufficient prey can't be found or adults die and are not replaced or time. The goshawk population across the Forest probably won't decline noticeably 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 probably be reduced.

The Forest Plan has relevant objectives (p. 1-4) to maintain or improve habitat across the Forest for MIS in the long term and for moving terrestrial, aquatic, and riparian area composition, structure, patterns, and processes toward conditions typical of those created by natural processes. No action in the analysis area would, of course, allow the natural process of beetle outbreaks to occur on the Forest. Goshawk nesting habitat could return within 80 years. Foraging habitat would remain. In fact, the accumulation of snags and coarse woody debris over time would provide a type of foraging habitat that is limited on the Forest. So, no action would provide goshawk habitat in the long term. Forest Plan (2003) standards and guidelines for MIS and habitat that relate to the interaction of beetles, habitat, and wildlife will be met (Appendix B).

Cumulative Effects of No Action

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, canopy cover, interlocking limbs, 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 75,000 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, suitable nesting stands that are lost won't all die at the same time, and some existing 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. Harvest among the Ryan Park-Tenmile, Box Canyon, Singer Peak, Blackhall/McAnulty, Cottonwood Rim, Soldier Summit, Silver Run, White Rock Estates, French Creek, Devil's Gate projects and the proposed Spruce Gulch project will remove approximately 2648 acres of nesting habitat across the Forest. This is only 1.3% of the more than 200,000 acres of potential nesting habitat available across the Forest. These will regenerate to nesting habitat in approximately 80 years.

Some timber harvest occurred on state lands across the Forest. The state of Wyoming completed 380 acres of harvest and 5.2 miles of road construction among Billie Creek, Dudley Creek, and Damfino Creeks. All these areas are suitable habitat for goshawks but the Damfino section occurs above the elevation found to be suitable for nesting on the Forest (Squires and Ruggiero 1996). Harvested areas will be available for foraging but quality will be very low since state lands have no requirements to retain live trees, snags, or coarse woody debris that provide structural features to prey habitat. Nesting habitat will be lost on 215 acres from approximately 800 acres of nesting habitat available within these state lands. These areas will regenerate to nesting habitat in no less than 80 years.

A benefit of widespread and complete beetle-killed stands to goshawks in the long term is that widespread beetle outbreak will provide large expanses of high densities of snags and coarse woody debris as habitat for some prey species. This habitat is limited on the Forest. Dillon et al. (2003) indicated that snags and coarse woody debris 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.

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. Even without beetle-killed stands, the Forest has occupied goshawk territories where successful nesting does not occur. Some territories with lodgepole nesting habitat probably won't be affected by beetles; some territories also have aspen nesting habitat. A few territories might be abandoned if sufficient prey can't be found or adults die and are not replaced or time. The goshawk population across the Forest probably won't decline noticeably 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 probably be reduced.

Overall, natural and man-made activities across the Forest are regenerating about 30% of nesting habitat on the Forest over the next several years; overwhelmingly due to the beetle outbreak. Forest

management is changing only 3% of this habitat. These represent a modest change and might reflect a change in the goshawk forestwide. However, nesting habitat also exists in mature aspen stands. This level of change is probably within HRV. Indeed, the Forest Plan estimated that 52,000 acres would regenerate naturally over the next 50 years (USDA 2003, p. 3-113). Dillon et al. (2003) indicated that periodic episodes of severe insect damage most likely will always be a part of Rocky Mountain forest dynamics and mortality caused by insects has probably been the second most important form of disturbance in high-elevation forests. Of course, the goshawk population on the Forest survived these episodes of severe insect damage. The forestwide population trend for goshawks should mimic the amount of mature lodgepole remaining during and after the beetle outbreak. Goshawk population stability on the Forest would reflect the small temporary loss of some late seral lodgepole that has occurred so far, which is within HRV for these habitat changes. Therefore, population stability would mimic the long-term stability of late seral lodgepole, the reason for which goshawk was selected as a MIS for the Forest.

PROPOSED ACTION (Harvest) –**ANALYSIS OF LIKELY EFFECTS TO GOSHAWK**

There are 16 known goshawk nests from 13 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 goshawks will be applied (p. 1-42) and treatment should not occur or should be appropriately adjusted. Surveys (Joy et al. 1994) 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. 1-42) are met. This process is generally identified in proposed action design criteria 13 and 14 but will be more thoroughly explained in the design feature at the end of this report.

There are also 72 nests from 42 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 (p. 1-42) and treatment should be appropriately adjusted. Surveys (Joy et al. 1994) 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 (p. 1-42) are met.

There are an additional 46 other known goshawk territories that include approximately 212 nests across the Forest. None of these nests are within or near proposed action sites.

There are currently about 200,000 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 9523 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 (Joy et al. 1994), as identified in design features, will ensure that Forest Plan standards are followed (p. 1-42) 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. Of course, 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.

Foraging goshawks would be expected to leave the immediate area surrounding treatment units due to the noise disturbance caused by mechanical equipment. Forest Plan standards (p. 1-42) would protect a ¼ mile area around any active nests, so these should not be disturbed. One study in Arizona concluded that audible noise from loaded log trucks passing ¼ mile or more away from a goshawk nest was barely louder than ambient noise levels and produced no "discernable behavioral response" in observed goshawk adults or young (Grubb *et al.* 1998). Immediately after harvest, goshawks could return to those treated areas for foraging.

All proposed harvest units would remain foraging habitat but 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 these structures within the low end of HRV; so they will be at an abundance that occurred on the Forest naturally. This abundance should provide features for prey habitat. Primary prey species (Squires 2000), the red squirrel and northern flicker, could decline slightly from these habitat changes. The resulting 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.

The loss of 9523 acres of nesting habitat would occur across numerous known and potential territories. Changes within any territory would be small enough not to substantially change nesting or foraging behavior for goshawks. Sufficient nesting habitat will remain in each of these territories to allow goshawks to nest successfully.

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

The temporary loss of some suitable nesting habitat reflects the corresponding loss of a small amount of late seral lodgepole to harvest across the Forest. Monitoring of late seral lodgepole is one of the reasons goshawk was selected as a MIS for the Forest Plan. Forestwide habitat will not change noticeably under the proposed action. Only 4.7% of forestwide goshawk nesting habitat will be temporarily lost. This amount of change is well within the range of natural changes to the Forest. The forestwide population trend for goshawks should remain stable as long as Forest Plan standards for active nests are followed.

Goshawk was also selected as a MIS to monitor biodiversity of late seral lodgepole. Proposed action will not change the number of prey species available but abundance of individual species in the analysis area could change. Goshawk diets could change somewhat but prey would still be abundant with these habitat changes. For example, diet could shift somewhat to fewer red squirrels and more robins as a result of less live tree canopy cover. Forest Plan standards to retain recruitment trees, snags, and coarse woody debris (Appendix B) will assist in maintaining prey habitat. The change in prey consumption would reflect the change in abundance of several prey species in this portion of the Forest. The forestwide goshawk population should remain stable over time considering that adequate

prey habitat is expected to be available through time. In the longer term, goshawks could positively respond to the habitat changes as unaffected forest vegetation matures to provide nesting habitat while recruitment trees, snags, and coarse woody debris retained in harvest units provide foraging habitat and later nesting habitat.

The Forest Plan has relevant objectives (p. 1-4) to maintain or improve habitat across the Forest for MIS in the long term and for moving terrestrial, aquatic, and riparian area composition, structure, patterns, and processes toward conditions typical of those created by natural processes. Proposed action would maintain habitat across the Forest in the long term; only 4.7% will be temporarily lost. This amount of loss can be expected to occur naturally. Indeed, the Forest Plan estimated that 52,000 acres would regenerate naturally over the next 50 years (USDA 2003, p. 3-113). Forest Plan standards and guidelines that relate to timber harvest and roads will be met. Adhering to Forest Plan (2003) standards and guidelines (Appendix B) will assist meeting the Plan objectives. For example, snags will be retained in harvest units, so that some woodpecker prey will remain in harvested units. The amount of snags would be within HRV, so composition and structure would move toward conditions typical of those created by natural processes. Timber harvest that follows the Plan standards and guidelines will continue this movement toward "conditions typical of those created by natural processes".

Cumulative effects of the Proposed Action

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, canopy cover, interlocking limbs, 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 75,000 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, suitable nesting stands that are lost won't all die at the same time, and some existing 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. Harvest among the Ryan Park-Tenmile, Box Canyon, Singer Peak, Blackhall/McAnulty, Cottonwood Rim, Soldier Summit, Silver Run, White Rock Estates, French Creek, Devil's Gate projects and the proposed Spruce Gulch project will remove approximately 2648 acres of nesting habitat across the Forest. This is only 1.3% of the more than 200,000 acres of potential nesting habitat available across the Forest. These will regenerate to nesting habitat in approximately 80 years.

Some timber harvest occurred on state lands across the Forest. The state of Wyoming completed 380 acres of harvest and 5.2 miles of road construction among Billie Creek, Dudley Creek, and Damfino Creeks. All these areas are suitable habitat for goshawks but the Damfino section occurs above the elevation found to be suitable for nesting on the Forest (Squires and Ruggiero 1996). Harvested areas will be available for foraging but quality will be very low since state lands have no requirements to retain live trees, snags, or coarse woody debris that provide structural features to prey habitat. Nesting habitat will be lost on 215 acres from approximately 800 acres of nesting habitat available within these state lands. These areas will regenerate to nesting habitat in no less than 80 years.

A benefit of widespread and complete beetle-killed stands to goshawks in the long term is that widespread beetle outbreak will provide large expanses of high densities of snags and coarse woody debris as habitat for some prey species. This habitat is limited on the Forest. Dillon et al. (2003) indicated that snags and coarse woody debris 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.

Overall, natural and man-made activities across the Forest are regenerating about 30% of nesting habitat on the Forest over the next several years; overwhelmingly due to the beetle outbreak. Forest management is changing only 3% of this habitat. These represent a modest change and might reflect a change in the goshawk forestwide. However, nesting habitat also exists in mature aspen stands. This level of change is within habitat and goshawk population changes expected to occur naturally. Indeed, the Forest Plan estimated that 52,000 acres would regenerate naturally over the next 50 years (USDA 2003, p. 3-113). Of course, the goshawk population on the Forest survived these episodes of severe insect damage. The forestwide population trend for goshawks should mimic the amount of mature lodgepole remaining during and after the beetle outbreak. Goshawk population stability on the Forest would reflect the small temporary loss of some late seral lodgepole that has occurred so far, which is within HRV for these habitat changes. Therefore, population stability would mimic the long-term stability of late seral lodgepole and the retention and accumulation of coarse woody debris, the reasons for which goshawk was selected as a MIS for the Forest.

American Three-toed Woodpecker

Life History and habitat requirements

Life history information is available in Anderson (2003) and Wiggins (2004). Three-toed woodpecker is a sensitive species in Region 2 (addressed in the BE) and a MIS on this Forest. The three-toed woodpecker is primarily associated with high-elevation (above 8,900 feet), old-growth conifer forests, specifically spruce-fir and lodgepole habitats (Wiggins 2004, Cerovski 2004, Nicholoff 2003, USDA 1981). This association is especially linked to a dependence on mature, un-logged, and naturally disturbed forest stands (Wiggins 2004). The species shows a preference for spruce-fir forests (Bock and Bock 1974, Hoyt and Hannon 2002), although lodgepole forests are used extensively after disturbance (Wiggins 2004, Cerovski 2004, Nicholoff 2003). A limited number of records demonstrate utilization of ponderosa pine and aspen stands (Wiggins 2004, citing Versaw 1998; DeGraaf et al. 1991, USDA 1981). The species' flexibility in habitat use is predominately determined by their dependence on infestations of bark beetles and wood-boring beetles. The distribution of three-toed woodpecker is often patchy and variably irruptive, based on the distribution and abundance of beetle species on which they forage (Wiggins 2004, Nicholoff 2003, Imbeau 2002). The association of the species with disturbed, mature forests is a function of its reliance on bark and wood-boring beetles. Optimal habitat has been described as having approximately 50 snags per 100 acres. A minimum of one snag per 2 to 3 hectares is required (Nicholoff 2003). Aggregations of three-toed woodpeckers are typically exaggerated in the winter, as the species generally does not

migrate away from breeding grounds, but rather congregates in areas with abundant food resources (Wiggins 2004).

Reduction in amount of post-fire habitat has removed prime habitat. Removal of snags (in harvested areas) has reduced potential nest sites. The amount of old forest is believed to be within the range typical of the past; but patch size and interior forest have been reduced. At a broad scale, two habitat types that are becoming rare in boreal forest are post-burn early-successional stands and old growth (Schmiegelow and Monkkonen 2002), the two types used by this species. Old forests have declined in area on the Medicine Bow (Welp et al. 2000). Though the current area may not be outside of the historic range of variation (HRV), it is at the low end; maintaining old growth at the low end of the range over long periods would be out of HRV in terms of long-term patterns (USDA 2003, citing Dillon and Knight et al. 2003; and Finch and Stangel 1992).

The primary concerns (or potentially limiting factors) for three-toed woodpeckers are habitat changes due to logging, especially salvage logging (USDA 2003, p. I-173, Anderson 2003, Wiggins 2004) and fire suppression (Anderson 2003, Wiggins 2004). Relative to this project, proposed harvest can impact mature and older lodgepole and spruce-fir forest used by three-toed woodpecker. The three-toed woodpecker is a MIS for the Medicine Bow Plan addressing snags, old forest, and recently burned forest. Recently burned forest is not affected by this project.

Available habitat

Across the Forest, there are more than 300,000 acres of possible habitat distributed among the 4 mountain ranges (USDA 2003, p. 3-98, 123). A large amount of suitable habitat exists across the Forest and, due to its low abundance and transient nature, the species has a vast resource and habitat base to support a strong and stable population on-Forest. Continued maturation of late-seral spruce-fir and stable/increasing populations of bark beetles across the Forest will provide a large number of areas containing high-quality breeding and foraging habitat. The analysis of habitat changes for the 2003 Forest Plan revision indicated that mature lodgepole habitat changed less than 5% between 1985 and 2003 and indicated that mature spruce-fir decreased by less than 1% during the same period. The proposed actions that can influence population trend include timber harvest in lodgepole and no action includes a lodgepole beetle outbreak. Therefore, the three-toed woodpecker habitat pertinent to this project is the mature lodgepole proposed for harvest and this forest type that would be affected by beetles.

Population information

Several sources of information are available and useful for estimation current population status, trend, and abundance for three-toed woodpeckers on the Medicine Bow National Forest. These data reflect different landscape scales and include results that have been gathered over large geographic areas (*i.e.*, the southern Rocky Mountains) as well as locally (within the Coon Creek Analysis Area and Little Snake River drainage). While none of these data are independently adequate to estimate three-toed woodpecker population trend and abundance, and some information may even be contradictory, collectively the information affords a basis for making credible inferences about population trend and abundance for this species on the Forest.

This uncommon, inconspicuous woodpecker usually exists at very low densities. The species exists on the Forest, as it does over the rest of its range, with a broad distribution and low abundance. Concentrations of the species are irruptive and transient, based upon its preference for recent disturbances. Its distribution and abundance are dictated by available habitat and disturbances to it. They are found from Alaska, across Canada, and in the Rocky Mountains south to Arizona and New Mexico. The three-toed woodpecker is a yearlong resident, known to breed on the Medicine Bow National Forest. Breeding records for Wyoming occur in the most mountainous areas in the state except for the Black Hills (Cerovski et al. 2004).

The US Forest Service, Region 2, lists the three-toed woodpecker as a sensitive species (USDA 2003c). Three-toed woodpeckers are a Level II (Monitoring) species in the Wyoming Bird Conservation Plan (Nicholoff 2003) and Wyoming Natural Diversity Database (WYNDD) lists them as a Species of Concern (Keinath and Beauvais 2003). Wyoming Game and Fish (WGFD) listed this species as an uncommon resident (NSS4) (Cerovski 2004). The Wyoming Natural Heritage Program has this species listed as an S3 species within the state (vulnerable to extirpation), although it is considered demonstrably widespread or secure across the United States (NatureServe 2005).

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 the continental scale and at other geographic scales, as well. This data is available from the National Breeding Bird Survey (BBS). Population trend derived from these data implies a slightly increasing trend within Wyoming (+4.2%/year) and a strongly decreasing trend in the southern Rockies (-19.1%/year), which includes the Medicine Bow-Routt National Forest. Observations (and estimated trend) within Wyoming were focused in the northwestern portion of the state. The difficulty of detecting three-toed woodpeckers using BBS methodology is quite high and the annual counts of the species over the 36-year sampling period are sporadic and highly variable. Consequently, available data for this species are 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 the detection of three-toed woodpeckers on some BBS routes, the estimated decline is not significant (calculated $p= 0.54$ and 0.41, respectively from Sauer *et al.* 2004 estimating equation). However, this lack of statistical significance should not be interpreted to mean the trend is stable, but the test of significance indicates that the data thus far collected are inadequate to reject the null hypothesis ($\alpha=0.05$) that the real trend is different from 0. BBS survey methodology is not considered adequate to sample this woodpecker because of the ephemeral nature of some of their habitats (i.e. recently disturbed stands) and the low detectability of the species. Three-toed woodpeckers have not been observed on any BBS route on the Medicine Bow National Forest (Sauer et al. 2004).

The revised Forest Plan required (p. 4-17) that MIS data be collected annually and reported every 5 years using Class B surveys. Data collected to date is provided in Table 16 (2005 results pending). They are sufficiently uncommon that they have not been detected on any of the BBS routes on or adjacent to the Forest since the 1st route was surveyed in 1968. Therefore, survey design within the RMBO songbird protocol was specifically adjusted in 2003 to account for birds such as the three-toed woodpecker. Results from 2003 and 2004 are a combination of RMBO survey protocol transects and opportunistic observations (Table 8). After 2004, survey transects were standardized for monitoring across the Forest. Results suggest that the three-toed woodpecker population trend appears to be stable across the Forest but conclusions are tentative until the Forest Plan's 5 year monitoring is available. Fluctuations exhibited in Table 8 can be related to observer effort and natural, yearly variation in climate and prey, consistent with habitat analysis.

Table 8. Three-toed woodpecker monitoring across the Forest.

YEAR	# Observed	# Survey Transects
1999	1	0
2000	1	0
2001	1	0
2002	1	0
2003	21	16
2004	39	20
2005	15	26
2006	41	26

2007	52	26

The Forest Service's NRIS FAUNA database contains 25 records of three-toed woodpecker observations, representing the Snowy Range, Sierra Madre, and Laramie Peak units of the Medicine Bow National Forest. These records account for 33 individual woodpeckers observed. Two records were documented as reproduction, one a family group of 4 woodpeckers, and the other a lone woodpecker observed at a nest with an unknown number of nestlings.

Jenniges (1991) reported observing 6 individual three-toed woodpecker within the North Fork drainage of the Little Snake River. Loose (1993) observed 31 foraging locations of the species on the Medicine Bow National Forest.

A preliminary study was conducted in the Coon Creek Timber Sale before treatment to determine avian species abundance in various habitats. Successive monitoring was not performed. Raphael (1987) reported mean densities of species in the Coon Creek and East Fork watersheds. Three-toed Woodpeckers were found at a density of less than 1 bird/100 hectares in pole size lodgepole habitat, increasing to 1 bird/100 hectares of sawtimber size lodgepole. The greatest density, reported for sawtimber size spruce-fir, was 2 birds/100 hectares.

MIS monitoring of the Gramm fire vicinity and Vienna salvage project occurred in the fall of 2003. Monitoring conducted during August and early September resulted in 13 incidental observations of three-toed woodpeckers. Monitoring conducted on October 12th of 2003 resulted in the detection of 14 three-toed woodpeckers in a single day. Kozlowski (unpub. data) reported that the species was present surrounding the project area with a population of moderate size, and that the post-burn area strongly attracted nearby three-toed woodpeckers, which were observed more frequently and more concentrated in areas around where the fire occurred.

Conclusions

Cumulative effects, identified previously, of habitat change upon three-toed woodpeckers and their habitat provide some concerns as to future trends. However, currently the amount of available habitat (246,824 acres) and number of woodpeckers appears to be quite good. Currently, the habitat conditions and available data suggest the three-toed woodpecker population on the Forest has a trend that is stable and will remain so. Natural disturbances will continue to occur across the Forest and, additionally, the Forest Plan contains standards and guidelines to ensure the protection of three-toed woodpecker habitat, particularly old-growth. The species is extremely good at discovering and utilizing areas of recent disturbance. Their broad distribution and low abundance across the Forest allows them to effectively exploit many disturbances with low levels of competition. Irruptions are typically aggregations of the local population within an area of high resource availability. The aggregation is then able to disperse in order to exploit lower resource levels over a larger geographic area, or follow the movements of the bark beetle population across the Forest.

The natural uncommonness of the species does make it susceptible to changes across the Forest and potential limits to its persistence include many current management practices, such as salvage logging of recent fires and beetle outbreaks, loss of late-successional forests, and fire suppression. However, with proper management of these activities the Forest will continue to provide much quality habitat to support the population. Recently, a very large number of three-toed woodpecker observations have been made, suggesting that the species is holding stable, or potentially increasing with the current beetle populations across the Forest and the occurrence of fires through the drought situation. Continued monitoring of the species will continue to increase and support the amount of data and knowledge that exists on the Forest and elsewhere, for the three-toed woodpecker, in addition to

understanding and adapting accordingly to impacts upon the species as a result of Forest management.

NO ACTION (No harvest) –**ANALYSIS OF LIKELY EFFECTS TO THREE-TOED WOODPECKER**
Endemic levels of insects and pathogens and natural fire intervals play significant ecological roles including tree mortality, defoliation, decay, and deformity. These processes are important attributes in three-toed woodpecker foraging and nesting (cavity excavating) habitat. No action would result in generally positive effects to three-toed woodpecker.

Potential three-toed woodpecker habitat across the Forest 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 300,000 acres of habitat across the Forest. Three-toed woodpeckers use habitat adjacent to the Forest's open roads, trails, and administrative sites (collectively admin features). However, three-toed nesting use could be reduced since research mentioned earlier (p. 11-12) indicated wildlife habitat quality is reduced and disturbance is increased near roads. These areas would still be used for foraging since local experiences indicate that beetles are not avoiding trees near admin features.

Where pine beetles move through stands near admin features at epidemic levels, three-toed woodpecker habitat quality will change through time. The spread of bark beetles would greatly increase prey availability, increasing three-toed woodpecker density during the outbreak. Resulting snags would provide nesting habitat as long as sufficient density of live or dead canopy and limbs remained to prevent nest sites from being directly exposed to weather elements. Hitchcox (1996), studying bird abundance immediately after a 1600 ha severe fire in conifer stands, found that 89% of three-toed woodpecker nests were at sites ranging from ≤40% green trees to completely brown-needled trees. Nest snags directly exposed to weather such as periodic high winds are not expected to stand long. Nest cavities directly exposed to wind, sun, and temperature variations are not expected to provide a favorable environment for raising young. Still, dead lodgepole would remain nesting habitat for a few decades and much nesting habitat will be available in mature and older spruce stands that are also adjacent to admin features.

Overall, no action could allow the maturing of forested habitat with increases in spruce-fir habitat through succession. These actions could increase three-toed woodpecker habitat. Some important components of three-toed woodpecker habitat, snags and coarse woody debris, would be increased by a combination of insect outbreaks, tree pathogens, and wildfires.

Individual three-toed woodpecker should have greater fitness and survival under no action. Nesting sites will be abundant; food sources will be abundant and close to nest sites. Several researchers (see Wiggins 2004) have documented dramatic increases in three-toed woodpeckers in such areas of disturbance, with the woodpeckers taking full advantage of improved habitat quality. In high quality habitat, three-toed woodpecker have been found at densities as high as 7–10 birds/40 ha (98.8 acres). This density of three-toed woodpeckers has not observed during MIS surveys. A higher density within the beetle outbreak is expected to last as long as the beetle outbreak lasts. When beetles decline again to endemic levels, the three-toed woodpecker density will have a corresponding decline to the normally expected level.

The Forest Plan has relevant objectives (p. 1-4) to maintain or improve habitat across the Forest for MIS in the long term and for moving terrestrial, aquatic, and riparian area composition, structure, patterns, and processes toward conditions typical of those created by natural processes. No action in the analysis area would, of course, allow the natural process of beetle outbreaks to occur in the analysis area. Three-toed woodpecker habitat acres would be maintained while the quality would improve during the beetle outbreak. Habitat quality will return to normal levels after the beetle outbreak. So, no action will provide three-toed woodpecker habitat in the long term. Forest Plan

standards and guidelines (USDA 2003) for MIS and habitat that relate to the interaction of beetles, habitat, and wildlife will be met.

Cumulative effects for No Action

Habitat immediately adjacent to the current road system provides reduced quantity and quality habitat to wildlife (see p. 11-12). 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 woodpecker use. There are still several hundred thousands of acres of nesting and foraging habitat across the Forest away from roads.

Prey abundance across the Forest is expected to increase substantially under the beetle outbreak. There should also be a sharp increase in nesting habitat across the Forest caused by the sharp increase in snags. This improved habitat will last as long as the beetle outbreak continues. When beetles decline again to endemic levels, the three-toed woodpecker density across the Forest will have a corresponding decline to normally expected level. Most beetle-killed trees from the next few years are likely to be still available as hard snags suitable for nesting sites for 25 years (see USDA 2003, p. D-80). Other snags will be too soft or will have fallen in 25 years. Overall, Forestwide nesting habitat quality is expected to increase through time under the beetle outbreak.

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 woodpecker habitat. Burned conifer stands would provide a unique and limited habitat, important for these woodpeckers as foraging habitat and future nesting snags. Natural tree mortality from beetles, disease or wildfire would attract insect prey species of woodpeckers. Wiggins' (2004) concluded that three-toed woodpecker preferred nesting habitats included unlogged, old growth conifer forest and conifer forests with some form of natural disturbance with birds also exploiting recently burned (or otherwise damaged) forests that provide a rich supply of food. He also summarized that three-toed woodpecker density increases dramatically at disturbed sites.

The final extent of changes to woodpecker habitat from pine beetles or potential wildfires across the Forest is unknown. Surveys indicate that 75,000 acres had already been affected by beetle-kill by 2006. Much of this is comprised of large lodgepole trees potentially used for nesting. These acres would remain as nesting and foraging habitat under no action but the quality of this habitat would improve. Indeed, beetle-infested or burned areas would provide a unique and limited habitat highly desired by three-toed woodpeckers. Woodpecker density in beetle-infested areas would be higher than in the surrounding forest. Woodpecker density would be expected to continue to be elevated as long as the beetle population continued beyond endemic levels. This habitat would only become unsuitable when snags have fallen and younger regeneration dominates the affected sites after several decades.

Some timber harvest is occurring or is planned to occur across the Forest. Harvest among the Ryan Park-Tenmile, Box Canyon, Singer Peak, Blackhall/McAnulty, Cottonwood Rim, Soldier Summit, Silver Run, White Rock Estates, French Creek, Devil's Gate projects and the proposed Spruce Gulch project will remove approximately 6000 acres of nesting habitat across the Forest. This is only 2% of the more than 300,000 acres of potential nesting habitat available 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 in approximately 100 years.

Some timber harvest occurred on state lands across the Forest. The state of Wyoming completed 380 acres of harvest and 5.2 miles of road construction among Billie Creek, Dudley Creek, and Damfino Creeks. All clearcuts these areas, 350 acres, are assumed to be suitable as three-toed woodpecker habitat. The 350 acres of harvest will temporarily eliminate these stands as three-toed woodpecker habitat. These stands will not be available as foraging habitat as regeneration occurs because state lands have no requirements to retain live trees, snags, or coarse woody debris that provide structural features to prey habitat. Nesting habitat will be lost for about 100 years until sufficient regeneration occurs and appropriate cavity nests are available.

Habitat quality in lodgepole has been improved by beetles in approximately 30% (75,000 acres) of three-toed woodpecker forestwide habitat but habitat quantity will not change. This represents a small change and could reflect an increase in the three-toed woodpecker population forestwide. Local, dramatic three-toed woodpecker irruptions in response to beetles have been documented (see Wiggins 2004). Any increase in three-toed woodpecker density within local areas should be reflected in forestwide surveys since some three-toed woodpecker population monitoring surveys occur in what are becoming beetle-infested areas. This level of change is within habitat and three-toed woodpecker population changes expected to occur naturally. Dillon et al. (2003) indicated that periodic episodes of severe insect damage most likely will always be a part of Rocky Mountain forest dynamics and mortality caused by insects has probably been the second most important form of disturbance in high-elevation forests. Indeed, the Forest Plan estimated that 52,000 acres would regenerate naturally over the next 50 years (USDA 2003, p. 3-113). The forestwide population for three-toed woodpecker could show a slight increase for a few years while the beetle outbreak occurs. Over the course of a decade or longer; however, the population trend would appear stable relevant to this alternative. Longterm three-toed woodpecker population stability would reflect the small change in forestwide habitat over time and the localized increase in snags from beetles. Old forest would be lost in localized areas but would be replaced by beetle-killed areas desired by three-toed woodpecker. Snags and old forest were 2 issues for which three-toed woodpecker was selected as a MIS.

PROPOSED ACTION (Harvest) –ANALYSIS OF LIKELY EFFECTS TO THREE-TOED WOODPECKER

There are currently more than 300,000 acres of three-toed woodpecker habitat across the Forest. Proposed harvest in lodgepole stands would eliminate 12,699 acres of three-toed woodpecker beetle-killed nesting 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 beetles again begin infesting suitable older trees. These stands could return to nesting habitat in approximately 100 years as the regenerating forest matures.

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

The loss of 12,699 acres is spread across many home ranges. Harvest is distributed widely across the Forest in small strips around admin features, the beetle outbreak is creating more woodpecker habitat, and woodpecker density is increasing as habitat quality increases. So, the effect will likely be that any woodpeckers that lose territory to harvest will gain suitable habitat in adjacent areas away from admin features. Habitat changes from harvest, beetles, and forest regeneration over time will ensure a continuing supply prey and future nesting habitat and will contribute toward maintaining the three-toed woodpecker population on the Forest. Foraging habitat will always be available but nesting habitat will return in harvested stands within 50 to 100 years.

The increase in woodpecker habitat quality and expected increase in woodpecker density would correspond to the increase in snags but will contrast with the likely loss of old forest. Monitoring of old forest and snags are two of the reasons three-toed woodpecker was selected as a MIS for the Forest Plan.

The Forest Plan has relevant objectives (p. 1-4) to maintain or improve habitat across the Forest for MIS in the long term and for moving terrestrial, aquatic, and riparian area composition, structure, patterns, and processes toward conditions typical of those created by natural processes. Proposed action would maintain habitat across the Forest in the long term; only 4.2% will be temporarily lost. This amount of loss would be expected to occur naturally. Indeed, the Forest Plan estimated that 52,000 acres would regenerate naturally over the next 50 years (USDA 2003, p. 3-113). Forest Plan standards and guidelines that relate to timber harvest and associated roads will be met. Adhering to Forest Plan standards and guidelines (USDA 2003) will assist meeting the Plan objectives. For example, recruitment trees and snags will be retained in harvest units, so that three-toed woodpecker habitat is either retained or returns more quickly after harvest. The amount of snags retained is within HRV, so composition and structure would move toward conditions typical of those created by natural processes. Timber harvest that follows the Plan standards and guidelines will continue this movement toward "conditions typical of those created by natural processes".

Cumulative effects of the Proposed Action

Habitat immediately adjacent to the current road system provides reduced quantity and quality habitat to wildlife (see p. 11-12). 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 woodpecker use. There are still several hundred thousands of acres of nesting and foraging habitat across the Forest away from roads.

Prey abundance across the Forest is expected to increase substantially under the beetle outbreak. There should also be a sharp increase in nesting habitat across the Forest caused by the sharp increase in snags. This improved habitat will last as long as the beetle outbreak continues. When beetles decline again to endemic levels, the three-toed woodpecker density across the Forest will have a corresponding decline to normally expected level. Most beetle-killed trees from the next few years are likely to be still available as hard snags suitable for nesting sites for 25 years (see USDA 2003, p. D-80). Other snags will be too soft or will have fallen in 25 years. Overall, Forestwide nesting habitat quality is expected to increase through time under the beetle outbreak.

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 woodpecker habitat. Burned conifer stands would provide a unique and limited habitat, important for these woodpeckers as foraging habitat and future nesting snags. Natural tree mortality from beetles, disease or wildfire would attract insect prey species of woodpeckers. Wiggins' (2004) concluded that three-toed woodpecker preferred nesting habitats included unlogged, old growth conifer forest and conifer forests with some form of natural disturbance with birds also exploiting recently burned (or otherwise damaged) forests that provide a rich supply of food. He also summarized that three-toed woodpecker density increases dramatically at disturbed sites.

The final extent of changes to woodpecker habitat from pine beetles or potential wildfires across the Forest is unknown. Surveys indicate that 75,000 acres had already been affected by beetle-kill by 2006. Much of this is comprised of large lodgepole trees potentially used for nesting. These acres would remain as nesting and foraging habitat but the quality of this habitat would improve. Indeed,

beetle-infested or burned areas would provide a unique and limited habitat highly desired by three-toed woodpeckers. Woodpecker density in beetle-infested areas would be higher than in the surrounding forest. Woodpecker density would be expected to continue to be elevated as long as the beetle population continued beyond endemic levels. This habitat would only become unsuitable when snags have fallen and younger regeneration dominates the affected sites after several decades.

Some timber harvest is occurring or is planned to occur across the Forest. Harvest among the Ryan Park-Tenmile, Box Canyon, Singer Peak, Blackhall/McAnulty, Cottonwood Rim, Soldier Summit, Silver Run, White Rock Estates, French Creek, Devil's Gate projects and the proposed Spruce Gulch project will remove approximately 6000 acres of nesting habitat across the Forest. This is only 2% of the more than 300,000 acres of potential nesting habitat available 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 in approximately 100 years.

Some timber harvest occurred on state lands across the Forest. The state of Wyoming completed 380 acres of harvest and 5.2 miles of road construction among Billie Creek, Dudley Creek, and Damfino Creeks. All clearcuts these areas, 350 acres, are assumed to be suitable as three-toed woodpecker habitat. The 350 acres of harvest will temporarily eliminate these stands as three-toed woodpecker habitat. These stands will not be available as foraging habitat as regeneration occurs because state lands have no requirements to retain live trees, snags, or coarse woody debris that provide structural features to prey habitat. Nesting habitat will be lost for about 100 years until sufficient regeneration occurs and appropriate cavity nests are available.

Overall, proposed and on-going actions will retain more than 275,000 acres of suitable nesting and foraging habitat on the Forest. This amount is increasing with the beetle outbreak. Three-toed woodpeckers have been found at densities of 2/100 ha (Raphael 1987) in an area on this Forest where beetles were at low endemic levels. Proposed and on-going actions (18,699 acres) could temporarily eliminate the equivalent of 75 home ranges on the Forest. However, harvest is distributed widely across the Forest in small strips around admin features, the beetle outbreak is creating more woodpecker habitat, woodpecker density is increasing as habitat quality increases, and the preferred mature spruce-fir habitat remains intact. So, the effect will likely be that any woodpeckers that lose territory to harvest will gain suitable habitat in adjacent areas away from admin features. Habitat changes from harvest, beetles, and forest regeneration over time will ensure a continuing supply prey and future nesting habitat and will contribute toward maintaining the three-toed woodpecker population on the Forest.

Habitat quality in lodgepole has been improved by beetles in approximately 30% (75,000 acres) of three-toed woodpecker forestwide habitat but habitat quantity will not change. This represents a small change and could reflect an increase in the three-toed woodpecker population forestwide. Local, dramatic three-toed woodpecker irruptions in response to beetles have been documented (see Wiggins 2004). Any increase in three-toed woodpecker density within local areas should be reflected in forestwide surveys since some three-toed woodpecker population monitoring surveys occur in what are becoming beetle-infested areas. This level of change is within habitat and three-toed woodpecker population changes expected to occur naturally. Dillon et al. (2003) indicated that periodic episodes of severe insect damage most likely will always be a part of Rocky Mountain forest dynamics and mortality caused by insects has probably been the second most important form of disturbance in high-elevation forests. Indeed, the Forest Plan estimated that 52,000 acres would regenerate naturally over the next 50 years (USDA 2003, p. 3-113). The forestwide population for three-toed woodpecker could show a slight increase for a few years while the beetle outbreak occurs. Over the course of a decade or longer; however, the population trend would appear stable relevant to this alternative. Long-term three-toed woodpecker population stability would reflect the small change in forestwide habitat over time and the localized increase in snags from beetles. Old forest would be lost in

localized areas but would be replaced by beetle-killed areas desired by three-toed woodpecker. Snags and old forest were 2 issues for which three-toed woodpecker was selected as a MIS.

Golden-crowned Kinglet

Life History and habitat requirements

Life history information is available from Nicholoff (2003), USDA (2004), and Galati (1991). Golden-crowned kinglets (*Regulus satrapa*) are associated with high elevation coniferous forests, preferring to nest and forage within the interiors of dense, mature, old-growth stands. They are typically found in spruce-fir habitats having heavy canopy cover, often near streams. They can also be found, usually somewhat less abundantly, in mature lodgepole stands and mixed deciduous-conifer stands, especially those with a mature aspen component (Nicholoff 2003, USDA 1981). Golden-crowned kinglets are most prominently associated with spruce species, a connection that dominates the species' distribution (Nicholoff 2003, Galati 1991). Their usage of mixed stands is most common during migration and wintering at lower elevations than is typical during the breeding season (USDA 1981).

They are gleaning specialists, foraging mostly on insects and insect eggs (Nicholoff 2003, Galati 1991, USDA 1981). Foraging occurs in spruce, fir, and pine trees (Galati 1991) with birds gleaning insects from foliage, twigs, limbs, and bark of the trees (USDA 1981). Wintering birds forage opportunistically, but appear to subsist mainly on lepidopterous caterpillars in the canopy (Heinrich and Bell 1995).

Golden-crowned kinglets are sensitive to forest cutting and are less common in forests and stands that have been cut, partially cut, thinned (Nicholoff 2003) or in habitats with naturally open canopies (USDA 2004). The species is also sensitive to prescribed and wild fires, especially those reducing the canopy-cover (USDA 2004). Kinglets are the smallest passerine bird, with high energetic demands. Availability of roost sites such as tree cavities or squirrel nests are critical in winter. Relative to this project, proposed harvest can remove or thin mature and older lodgepole forest used by golden-crowned kinglet. The golden-crowned kinglet is a MIS for the Medicine Bow Plan addressing the uneven aged management in spruce-fir/within stand fragmentation issue, the condition and adequacy of canopy cover in spruce-fir stands including partial harvest effects. This will be referred to simply as canopy cover in spruce-fir stands. Relative to this project, beetle caused changes to habitat and proposed harvest can impact mature and older lodgepole used by golden-crowned kinglet, potentially affecting Forestwide population trend for these birds.

Available habitat

Across the Forest, there are 246,824 acres of habitat (USDA 2003, p. 3-123). Proposed actions occur in lodgepole and no action includes beetle-caused loss in this habitat. The analysis of habitat changes for the 2003 Forest Plan revision indicated that mature lodgepole habitat changed less than 5% between 1985 and 2003 and indicated that mature spruce-fir decreased by less than 1% during the same period.

Population information

In selecting the golden-crowned kinglet as an MIS for the 2003 Revision of the Forest Plan (USDA 2003), no concern existed for species viability or viability of local populations and "viability" was neither a rationale nor motivation for its inclusion on the Forest MIS list.

Several sources of information are available and useful for estimation current population status, trend, and abundance for golden-crowned kinglets on the Medicine Bow National Forest. These data reflect different landscape scales and include results that have been gathered over large geographic areas (*i.e.*, the southern Rocky Mountains) as well as locally (within the Coon Creek Analysis Area and

Little Snake River drainage). While none of these data are independently adequate to estimate golden-crowned kinglet population trend and abundance, and some information may even be contradictory, collectively the information affords a basis for making credible inferences about population trend and abundance for this species on the Forest.

The golden-crowned kinglet is classified as demonstrably secure, globally, by Natural Heritage Programs (NatureServe 2005). The species is found across most of North America, bounded by the distribution of spruce species. The global population is estimated at about 10 million individuals, with the greatest densities found near in coastal Pacific States. It is one of the most abundant species found in Oregon and Washington. However, it is much less abundant in Wyoming and Colorado. Statistically significant population declines of about 3% per year have been documented recently in California, Oregon, and Washington, crucial states to the population's viability. Despite the declines in the species' stronghold, significant increases of approximately 6% per year have been recorded in the eastern United States, likely due to spruce-fir reforestation. (USDA 2004)

The golden-crowned kinglet is a resident of Wyoming and is considered to be uncommon (Cerovski 2004). It is classified as a Level II priority species by Wyoming Partners In Flight, calling for population monitoring. A potentially declining population trend and loss of habitat are not considered critical at this time and Wyoming Partners In Flight considers the state-wide trend of the species uncertain (Nicholoff 2003). The species is classified as secure nationally, but the Wyoming Natural Heritage Program ranks the golden-crowned kinglet as vulnerable to extirpation within the state (NatureServe 2005).

The species is not listed as an R2 Sensitive species, but is suggested for consideration for other emphasis species lists. This is partly due to its relatively low abundance. Past heavy utilization of spruce-fir forests led to dramatic declines in kinglet abundance, but the species has been recovering well as a result of habitat improvements with some remaining vulnerability in Wyoming and the Region. (Patton 2001)

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 the continental scale and at other geographic scales, as well. This data is available from the National Breeding Bird Survey (BBS). Population trend derived from these data implies a decreasing trend within Wyoming (-9.6%/year) and the southern Rockies (-2.4%/year), which includes the Medicine Bow-Routt National Forest. The difficulty of detecting golden-crowned kinglets using BBS methodology is quite high and the annual counts of the species over the 36-year sampling period are highly variable. Consequently, available data for this species are 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 the detection of golden-crowned kinglets on BBS routes, the estimated decline is not significant (calculated $p= 0.30$ and 0.44, respectively from Sauer *et al.* 2004 estimating equation). However, this lack of statistical significance should not be interpreted to mean the trend is stable, but the test of significance indicates that the data thus far collected are inadequate to reject the null hypothesis ($\alpha=0.05$) that the real trend is different from 0.

Evidence of the species' broad distribution and low abundance on the Forest was gathered locally with a preliminary study conducted in the Coon Creek Timber Sale before treatment to determine avian species abundance in various habitats. Successive monitoring was not performed, but a great deal of local information was collected. Raphael (1987) reported mean densities of species in the Coon Creek and East Fork watersheds. Golden-crowned kinglets were found at a density of 29 birds/100 hectares in pole size lodgepole habitat, increasing to 33 birds/100 hectares of sawtimber size lodgepole. The greatest density, reported for sawtimber size spruce-fir, was 69 birds/100 hectares. The data indicated that golden-crowned kinglets are found at densities near 7 acres/pair

within high-quality habitat on the Forest, consistent with the broad distribution and low abundance observed over much of the species' range.

The Revised LRMP required (p. 4-17) that MIS data be collected annually and reported every 5 years using Class B surveys. Data collected to date is provided in Table 9. RMBO and district wildlife surveys since 2003 have suggested that the golden-crowned kinglet population trend appears to be stable across the Forest but conclusions are tentative until the Forest Plan's 5 year monitoring is available. Fluctuations exhibited in Table 9 can be related to natural, yearly variation in climate and prey, and are consistent with habitat analysis.

Table 9. Golden-crowned kinglet monitoring across the Forest.

YEAR	# Observed
2003	52
2004	68
2005	30
2006	74
2007	101

The NRIS FAUNA database contains 14 records of golden-crowned kinglet observations across all units of the Medicine Bow National Forest. These account for 41 individual kinglets observed. These local observations are also consistent with the species' broad distribution and low abundance.

Jenniges (1991) assessed habitat utilization of wildlife on the Forest in a study within the Little Snake River drainage. Avian monitoring located several golden-crowned kinglets at various locations on Deadman Creek, Harrison Creek, and Third Creek. Two seasons of observation (1989, 1990) resulted in the observation of 19 and 7 golden-crowned kinglets, respectively. Habitat relations were the focus of the study and no trend was available from it. Keller and Anderson (1992) conducted population monitoring of Forest species to analyze impacts created by fragmentation as a result of small-scale clearcutting. They found minimal impact to golden-crowned kinglet abundance with an average density of less than 1 kinglet per 10 hectares in both fragmented and unfragmented stands.

Scholl and Smith (2004) reported on populations and habitats of species on the Medicine Bow National Forest that are threatened, endangered, sensitive, or of concern. They suggest that the true trend is unknown, but that the golden-crowned kinglet is likely to be declining slightly on the Forest as a result of the loss of old growth and mature coniferous forests.

Conclusions

Across the Forest there has been some decrease in the mature lodgepole habitat type, but there has been little change in the core spruce-fir nesting habitat. This and available data suggest that the amount of suitable and quality habitat across the Forest is remaining stable and will continue to sufficiently support the population of golden-crowned kinglets. Continued monitoring of these habitats will help to track and forecast conditions and impacts upon the species as a result of management practices.

Available data support the idea that the golden-crowned kinglet population on the Medicine Bow National Forest is wide-spread at low abundance. Collectively, the available population and habitat information suggest that golden-crowned kinglets on the Medicine Bow National Forest have a population trend that is currently stable. The species is regularly observed both through surveys and opportunistic detections. It is broadly distributed and regularly observed for a species existing at low abundance. The non-significant decrease reported by BBS data does give some concern, but the extent of observations made on the Forest in the last two years of monitoring, combined with past studies conducted locally, suggests a stable population exists. Continued monitoring of the species

through the use of standardized survey methods will help to further develop and support trend information in the near future. A continuation of proper forest management implementation will provide maintenance or an increase of habitat quality for the species. Minimizing the impacts to canopy cover within late-successional spruce-fir habitats will support the population of golden-crowned kinglets and maintain a stable trend on the Forest.

NO ACTION (No harvest) –ANALYSIS OF LIKELY EFFECTS TO GOLDEN-CROWNED KINGLET

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.

Potential future increase in spruce-fir by successional replacement of lodgepole and the maturing of existing spruce-fir would provide nesting, foraging and roosting habitat. Potential wildfires are expected to occur although lodgepole and spruce-fir habitats are within the HRV (USDA 2003, p. 3-267). 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 246,000 acres of habitat on the Forest. Where mature tree loss is complete and widespread in lodgepole, the 75,000 acres on known beetle-infected stands could be lost as golden-crowned kinglet habitat. There would be more than 170,000 acres (69%) of habitat remaining on the Forest.

Keller and Anderson (1992) conducted some population monitoring of Forest species to analyze impacts created by harvest in the Snowy Range of this Forest. They found an average density of 1 golden-crowned kinglet/25 acres in forested habitats. The more than 246,000 acres of golden-crowned kinglet habitat on the Forest could accommodate more than 9800 golden-crowned kinglets. The loss of 75,000 acres for 100 years under complete and widespread beetle-kill could result in golden-crowned kinglets being reduced by 3000 individuals. 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.

This considerable temporary loss of golden-crowned kinglets would reflect the corresponding loss of canopy cover within old forest to beetles on the Forest. Monitoring of canopy cover changes in stands of old forest is the reason golden-crowned kinglet was selected as a MIS for the Forest Plan.

The Forest Plan has relevant objectives (p. 1-4) to maintain or improve habitat across the Forest for MIS in the long term and for moving terrestrial, aquatic, and riparian area composition, structure, patterns, and processes toward conditions typical of those created by natural processes. No action in the analysis area would, of course, allow the natural process of beetle outbreaks to occur in the analysis area. Golden-crowned kinglet habitat would return within 100 years depending on the growth rate of remaining understory trees. In fact, the accumulation of snags over time could improve golden-crowned kinglet habitat quality by providing an abundance of communal winter roosts over decades. So, no action would provide golden-crowned kinglet habitat in the long term. Forest Plan (2003) standards and guidelines (USDA 2003) for MIS and habitat that relate to the interaction of beetles, habitat, and wildlife will be met.

Cumulative effects for No Action

Habitat immediately adjacent to the current road system provides reduced quantity and quality habitat to wildlife (see p. 11-12). 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. Harvest among the Ryan Park-Tenmile, Box Canyon, Singer Peak, Blackhall/McAnulty, Cottonwood Rim, Soldier Summit, Silver Run, White Rock Estates, French Creek, Devil's Gate projects and the proposed Spruce Gulch

project will remove approximately 6000 acres of habitat across the Forest. This is only 2.4% of the more than 246,000 acres of habitat available 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.

Some timber harvest occurred on state lands across the Forest. The state of Wyoming completed 380 acres of harvest and 5.2 miles of road construction among Billie Creek, Dudley Creek, and Damfino Creeks. All clearcuts these areas, 350 acres, are assumed to be suitable as golden-crowned kinglet habitat. The 350 acres of harvest will temporarily eliminate these stands as golden-crowned kinglet habitat. These stands will not be available as foraging habitat as regeneration occurs because state lands have no requirements to retain live trees, snags, or coarse woody debris that provide structural features to prey habitat. Nesting habitat will be lost for about 100 years until sufficient regeneration occurs.

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.

Overall, natural and man-made activities across the Forest are regenerating about 30% of habitat on the Forest over the next several years; overwhelmingly due to the beetle outbreak. Forest management is changing only 2.4% of this habitat. These represent a modest change and might reflect a change in the golden-crowned kinglet population forestwide. However, preferred habitat also exists in mature spruce-fir stands. This level of change is probably within HRV. Indeed, the Forest Plan estimated that 52,000 acres would regenerate naturally over the next 50 years (USDA 2003, p. 3-113). Dillon et al. (2003) indicated that periodic episodes of severe insect damage most likely will always be a part of Rocky Mountain forest dynamics and mortality caused by insects has probably been the second most important form of disturbance in high-elevation forests. Of course, the golden-crowned kinglet population on the Forest survived these episodes of severe insect damage. The forestwide population trend for golden-crowned kinglet could decline slightly during and after the beetle outbreak. Golden-crowned kinglet population change would reflect the loss of some canopy cover within old forest; the issue for which golden-crowned kinglet was selected as a MIS.

PROPOSED ACTION (Harvest) –ANALYSIS OF LIKELY EFFECTS TO GOLDEN-CROWNED KINGLET

There are currently more than 246,000 acres of golden-crowned kinglet habitat across the Forest. Proposed harvest in lodgepole stands would eliminate 12,699 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 range of HRV; so, they will provide habitat features of cover and forage for the MIS golden-crowned kinglet.

Individual golden-crowned kinglets probably would not be displaced from the harvest units by mechanical activity. Changes due to beetle-kill will have already made many of these lodgepole stands unsuitable. Of the 31,335 acres proposed for treatment, only 4355 (14%) contain enough spruce-fir cover (≥10%) to retain at least some habitat characteristics. Individuals in the stands with ≥10% spruce-fir would move to unoccupied habitats or adjust their territories.

The loss of 12,699 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. Monitoring of canopy cover loss within old forest stands is the reason golden-crowned kinglet was selected as a MIS for the Forest Plan.

The Forest Plan has relevant objectives (p. 1-4) to maintain or improve habitat across the Forest for MIS in the long term and for moving terrestrial, aquatic, and riparian area composition, structure, patterns, and processes toward conditions typical of those created by natural processes. Proposed action would maintain habitat across the Forest in the long term; only 5% will be temporarily lost. This amount of loss would be expected to occur naturally. Indeed, the Forest Plan estimated that 52,000 acres would regenerate naturally over the next 50 years (USDA 2003, p. 3-113). Forest Plan standards and guidelines that relate to timber harvest and associated roads will be met. Adhering to Forest Plan standards and guidelines (USDA 2003) will assist meeting the Plan objectives. For example, recruitment trees and snags will be retained in harvest units, so that golden-crowned kinglet habitat is either retained for foraging or returns more quickly after harvest. The amount of snags retained is within HRV, so composition and structure would move toward conditions typical of those created by natural processes. Timber harvest that follows the Plan standards and guidelines will continue this movement toward "conditions typical of those created by natural processes".

Cumulative Effects of the Proposed Action

Habitat immediately adjacent to the current road system provides reduced quantity and quality habitat to wildlife (see p. 11-12). 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. Harvest among the Ryan Park-Tenmile, Box Canyon, Singer Peak, Blackhall/McAnulty, Cottonwood Rim, Soldier Summit, Silver Run, White Rock Estates, French Creek, Devil's Gate projects and the proposed Spruce Gulch project will remove approximately 6000 acres of habitat across the Forest. This is only 2.4% of the more than 246,000 acres of habitat available 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.

Some timber harvest occurred on state lands across the Forest. The state of Wyoming completed 380 acres of harvest and 5.2 miles of road construction among Billie Creek, Dudley Creek, and Damfino Creeks. All clearcuts these areas, 350 acres, are assumed to be suitable as golden-crowned kinglet habitat. The 350 acres of harvest will temporarily eliminate these stands as golden-crowned kinglet habitat. These stands will not be available as foraging habitat as regeneration occurs because state lands have no requirements to retain live trees, snags, or coarse woody debris that provide structural features to prey habitat. Nesting habitat will be lost for about 100 years until sufficient regeneration occurs.

Overall, natural and man-made activities across the Forest are regenerating about 38% of habitat on the Forest over the next several years; overwhelmingly due to the beetle outbreak so far (75,000 acres). Forest management is changing only 8% of this habitat. These represent a modest change and will probably reflect a change in the golden-crowned kinglet population forestwide. However, preferred spruce-fir is not being affected nesting habitat also exists in mature aspen stands. This level of beetle-caused change is greater than changes expected to occur naturally. The Forest Plan estimated that 52,000 acres would regenerate naturally over the next 50 years (USDA 2003, p. 3-113). Of course, the golden-crowned kinglet population on the Forest survived these episodes of severe insect damage. The forestwide population trend for golden-crowned kinglets should mimic the amount of old forest and openings created across the forest during and after the beetle outbreak, the reasons for which golden-crowned kinglet was selected as a MIS for 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). Among other conservation programs, the Forest Service is a signatory to PIF (USDA 2003, p. 3-271). 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).

DESIGN FEATURES

Locations of the proposed action harvest units include or are near known goshawk nests. There are 16 known nests from 13 territories across the Forest that are within harvest units of the proposed action. There are also 72 nests from 42 known territories within ¼ mile of proposed actions. It is likely there are other undiscovered nests within or near proposed actions based on this information. Some monitoring results indicate that some goshawks continue to nest in beetle-killed pine forest (see

Graham et al. 1999). Medicine Bow Forest Plan standards for threatened, endangered, and sensitive species include the following for goshawks:

4. Within each occupied northern goshawk territory, select three nests and protect 30 acres of dense vegetation surrounding each, defining the boundaries of each area based on habitat quality. If fewer than 3 nests are found within an occupied territory, substitute 30-acre areas with characteristics of nesting habitat. [Medicine Bow NF]

5. Within each occupied northern goshawk territory, designate a northern goshawk post-fledging area (PFA) of a minimum of 200 acres that includes the three 30-acre nest sites selected. The large tree component within the PFA should include snags, down dead wood, and clumps of trees with interlocking crowns. Within the PFA, prohibit management activities that may degrade goshawk foraging habitat. [Medicine Bow NF]

6. To help reduce disturbance to nesting goshawks, prohibit construction, drilling, timber harvest and fuel treatments, and other intensive management activities within ¼ mile of active northern goshawk nests from April 1 to August 30 unless site-specific conditions are such that a lesser distance can be shown to provide the same degree of protection. [R2 Desk Guide]

Standard 5 will be met with the proposed action and its included 34 design criteria since promoting lodgepole regeneration will also provide foraging habitat.

The Proposed Action includes Design Criteria 13 and 14 to protect species including goshawks. These Design Criteria state:
13. Prior to each field season, provide district wildlife biologists and botanists with GIS layers and hardcopy maps. PETS species and species of local concern (known or discovered during project layout or implementation) will be individually evaluated as they occur within proposed hazard tree removal projects.
14. District wildlife biologists and botanists will determine consultation and site protection needs on an individual and as needed basis. For any PETS species or species of concern with identified viability concerns, the wildlife biologist and/or botanist will identify activity restrictions (area, timing etc.) such that implementation will not result in a trend toward Federal listing or loss of population viability.

It is my professional opinion that Design criteria 13 and 14 will meet Forest Plan standards 4 and 6 for goshawks as long as the Forest acquires the resources to survey these units for active goshawk nests prior to implementation. Not finding active nests until implementation is not likely to provide the ¼ mile no disturbance buffer during nesting or allow 90 acres of nesting habitat to be protected surrounding the active nest. Joy et al. (1994) modified an existing sampling technique that efficiently locates active goshawk nests. The Forest has been using this technique successfully for years and can accurately survey 200 acres/person/day during the nesting season (approx. June 21 – August 4). This technique can ensure that Forest Plan standards for nesting goshawks are met.

Alternate Scientific Views

Research was reviewed in order to gain wide professional views on the effects of no action or proposed action to wildlife or wildlife habitat. This research is identified in the "REFERENCES" section and cited throughout this report. For example, fragmentation in relation to martens, in particular, includes research with differing conclusions. These differences were addressed in this document.

There was also some differing information on canopy cover in goshawk nesting habitat. Both sets of information were addressed.

Forest Plan Consistency

Objectives, standards, and guidelines (USDA 2003) relevant to the Hazard Tree analysis area, the Forest, were reviewed. Each was analyzed, comparing no action and the proposed action to these in reference to the wildlife resource. The Hazard Tree no action and proposed action will meet these objectives, standards, and guidelines when design features are applied. Other objectives, standards, and guidelines relevant to the analysis area are addressed in other specialists' reports.

Standards and guidelines addressing threatened or endangered species were addressed in the Biological Assessment. Consultation is on-going with the US Fish and Wildlife Service, Cheyenne Field Office for this project.

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