ISSUE 22: WOLVERINE

Changes from the Draft to the Final EIS

Following is an overview of changes made to this section from what was presented in the Draft EIS.

- Alternative 7 of the Draft EIS has been replaced with Alternative 7-Modified (7-M). Analysis and comparison of alternatives discussed in this section have changed accordingly.
- New information was added from an ongoing study on wolverines (R. Inman, pers. comm. 2005). This study includes portions of the Gallatin National Forest.
- Additional literature was incorporated including Weaver et al. 1996 and Krebs et al. 2004.
- Non-motorized route density was evaluated for Wilderness TPAs.
- For the Final EIS, a forest-wide summary of impacts associated with travel management was included in the direct and indirect effects section. This summary was presented in the cumulative effects section in the Draft EIS.
- The effects analysis for general winter wolverine habitat was revised to assess a combination of winter route densities with proportions of landscape open to disbursed snowmobile use. The analysis for general winter habitat in the Draft EIS looked at winter route densities and snowmobile area closures.
- The Cumulative Effects Analysis was expanded based on the "General Description of Other Activities and Programs" report (Christiansen 2006). A summary is provided for the FEIS, with a detailed analysis available in the project file (Dixon 2006b).
- Programmatic Direction (e.g. goals, objectives, standards and guidelines) changed slightly and were organized differently for Alternative 7-M, so the evaluation of the effects of programmatic direction changed accordingly between Draft and Final EIS.

Introduction

This Issue addresses the potential effects of the Travel Plan alternatives on wolverine. Implementation of travel management decisions would directly influence the spatial and temporal distribution of human activities on National Forest lands. Human activities, including motorized and non-motorized access and associated recreation, can directly, indirectly and cumulatively influence wolverine distribution, reproduction and survival, and thus have the potential to affect wolverine populations in the Gallatin National Forest. In this area, wolverines are classified as a Forest Service sensitive species, which include those species identified by the Regional Forester for which population viability is a concern. The Montana Natural Heritage Program and Montana Fish, Wildlife and Parks Department also consider the wolverine a Species of Concern (MNHP 2006).

Affected Environment

Wolverines occur in all mountain ranges on the Gallatin National Forest. They are considered forest carnivores because they typically occupy habitats within or near forest cover. In a study of wolverines in northwest Montana, Hornocker and Hash (1981:1291) found that large areas of mature forest and associated ecotonal habitats of open, rocky and alpine areas accounted for the

majority of wolverine locations. Habitat types used most frequently in this study included subalpine fir (*Abies lasiocarpa*) and associated seral species. Hornocker and Hash (1981:1299) also reported that wolverines seemed reluctant to traverse large openings such as recently harvested or burned areas.

Wolverines have large home ranges for animals their size. In northwest Montana, Hornocker and Hash (1981) found average home range sizes of this species to vary from 100 km^2 (appx. 38 mi^2) for females with young, to 422 km^2 (163 mi^2) for adult males. A more recent study, which includes part of the Gallatin National Forest, is finding even larger home range sizes, averaging 645 km^2 (249 mi^2) for adult females and 1,204 km^2 (465 mi^2) for adult males (R. Inman, pers. comm. 2005). Individuals are capable of making long distance movements over short periods, including travel over extremely rough terrain and through deep snow. They can travel continuously for distances of up to 65 km (40 mi) without rest if pursued (Hash 1987). Physical barriers such as mountain ranges, valley bottoms, large rivers, reservoirs and major highways do not appear to affect movement patterns of wolverines (Hornocker and Hash 1981:1299). Wolverines are active year-round throughout their range and although capable of long-distance movement, they are not migratory. The wolverine is typically associated with vast, remote, undisturbed areas of limited human intrusion. However, they are known to cross through human developments and high human use areas during long-range movements (Hash 1987). Even though a preference for remoteness is evident across the wolverine's range, they continue to occupy some of the smaller mountain ranges with high levels of human use on the Forest, including the Bridger, Bangtail and Crazy mountain ranges.

Wolverines are considered habitat generalists in the summer, using a foraging strategy typical of opportunistic omnivores (Banci 1994:113). Summer habitat use is influenced by food availability, temperature regulation and breeding activities. Food is more available in spring and summer with a wider variety of potential food sources including carrion, small mammals, insects and insect larvae, eggs and berries. Both male and female wolverines occupy higher elevations where temperatures are cooler during the summer months (Hornocker and Hash 1981:1298). Wolverine breeding seasons vary from late spring to early fall, but generally occur during early summer (Hash 1987). Breeding activities influence habitat use and movement patterns of males but not females (Hornocker and Hash 1981:1298). Delayed implantation of embryos results in winter birthing of kits, generally between January and April (Banci and Harestad 1988). Of the wolverine births documented in the Greater Yellowstone Ecosystem, two of which occurred on the Gallatin National Forest, all were recorded in February (Inman, pers. comm. 2005).

Wolverines remain active year-round, and in winter adapt their foraging strategy to that of scavenger. Physical adaptations such as massive skull structure, powerful jaws, strong teeth and overall body strength make the wolverine highly suited for feeding on carrion, including the ability to crush large bones and chew through frozen meat (Haglund 1966). An additional adaptation to this foraging strategy is an acute sense of smell, which allows wolverines to locate carrion in deep snow. As scavengers, winter wolverine foraging habitat becomes more of an association with other species; in other words, food sources for wolverines will be somewhat dictated by the distribution of big game species. Wolverines are capable of direct predation on animals many times their size, particularly when prey animals are weakened, injured or bogged down in deep snow. However, wolverines are not as efficient at killing as other carnivores such as mountain lion (*Felis concolor*)

and gray wolf (*Canis lupus*), therefore, the wolverine's winter foraging habitat is also somewhat correlated to the distribution of these primary predators (Hash 1987).

Hornocker and Hash (1981:1291) reported a distinct seasonal shift in elevation use patterns, with both male and female wolverines inhabiting lower elevations during winter. This shift was most likely associated with food availability in the form of ungulate carrion and small mammals. Winter forest carnivore surveys on the Gallatin Forest and an on-going study on wolverines in the Madison Range (Inman et al. 2003) have recorded the majority of winter wolverine locations at elevations above 2,073 m (6,800 feet). Winter presents a very challenging time for wolverines, since they not only have to be in constant search of limited food supplies, but the denning season for reproductive females also occurs during winter.

Across the wolverine's range in all of North America and Eurasia, the majority of known natal den sites involve areas of deep snow accumulation, with snow tunnels often forming part of the den infrastructure (Pulliainen 1968, Magoun 1985, Copeland 1996). Den sites located in forested habitat have typically been associated with spruce (*Picea* spp.) habitats. Wolverine dens have also been reported in hollow logs, tree cavities, abandoned beaver lodges, under down logs and in log jam debris (Banci 1994:110). Fewer than ten reproductive den sites have been documented in the contiguous United States (J. Copeland, USDA Forest Service and K. Inman, Wildlife Conservation Society, personal communication).

Magoun and Copeland (1998) describe wolverine reproductive dens found in Alaska and Idaho. A series of den sites are often used during the reproductive season. Natal dens are those where kits are born, whereas maternal den sites are used after parturition, but before weaning of kits. Dens used by wolverine families after kits are weaned are referred to as rendezvous sites. Nearly all verified reproductive den sites reported by these authors were found at higher elevations, in areas where snow regularly accumulates to depths of 1-5 m (3-16 feet). Den sites involve extensive snow tunnel systems, often associated with large rocks or fallen trees, and sometimes lead to adjacent tunnel systems in boulder talus piles. On the Gallatin Forest and elsewhere in the GYE, documented natal den site characteristics are similar to those described above, but have generally been associated with avalanche debris, rather than boulders and talus (Inman, pers. comm. 2005).

GIS modeling was used to predict the occurrence of potential female wolverine denning habitat in the Gallatin National Forest. The model was based on reproductive den site characteristics described by Magoun and Copeland (1998). Only National Forest lands were included in this exercise, since there is not good habitat type data available for other land ownerships. However, the vast majority of high elevation areas suited for wolverine denning habitat are on National Forest lands. Habitat characteristics used to identify potential denning habitat included elevations above 2,290 m (7,500 feet) and north or northeast aspects, with ground cover of tundra, talus, Krummholtz, and/or mature spruce, subalpine fir or whitebark pine (*Pinus albicaulus*). Queries based on these landscape characteristics indicated that there are approximately 60,153 ha (148,637 acres) of potential reproductive denning habitat within the Gallatin Forest boundary. Fifty-three percent (31,881 ha or 78,606 acres) of the potential denning habitat is located within established Wilderness. Denning habitat is fairly well distributed at higher elevations across the Forest.

Direct and Indirect Effects

Large home range sizes coupled with low reproductive rates and resulting naturally low densities across occupied habitat make wolverines more vulnerable to population decline and local extirpation than many other wildlife species. Weaver and co-authors (1996:964) examined studies of large carnivores in the Rocky Mountains in order to evaluate the resilience of multiple species to environmental perturbations. Their conclusion based on existing empirical data was that wolverines have perhaps even lower resilience to disturbance than other species examined, which included grizzly bears (*Ursus arctos*), gray wolves (*Canis lupus*) and mountain lions (*Felis concolor*).

Analysis Methodology

Potential effects of travel management on wolverines were assessed using a variety of tools. Public comments received in response to the Travel Planning Benchmark (USDA 2002) were reviewed to identify any potential issues not previously recognized by Forest Service specialists. Agency monitoring and surveying records were reviewed for insight to wolverine occurrence, distribution and habitat use patterns within the Forest. A thorough literature review was conducted for additional information on wolverine biology, ecology and possible impacts from public access. Input was solicited through personal contacts with research and management biologists from within the Forest Service, other agencies (Montana Department of Fish, Wildlife and Parks, US Fish and Wildlife Service, Rocky Mountain Research Station), and private organizations with expertise in wolverine biology and management. Computer models were used to analyze impacts at the landscape-scale, in order to quantify the proportion of certain types such as reproductive denning habitat available in the analysis area, and how various Travel Plan alternatives might alter wolverine habitat or use of habitat.

For comparison purposes, Alternative 1 was considered to best represent the existing condition regarding direct and indirect effects to wolverines and their habitat. Most of the habitat alteration associated with Forest travel management exists under Alternative 1, including effects from motorized off-route travel that was permitted in the recent past, as well as habitat impacts from the presence of project roads and user-built routes. Alternative 1 also best represents the existing condition for evaluating disturbance effects, since this alternative considers impacts currently resulting from use on all existing open system roads and trails, plus public motorized use on many project roads and user-built routes. Alternatives 1 and 2 are essentially the same for winter use and both equally represent the existing condition for winter travel management.

Analysis areas used for evaluating effects of travel management on wolverines include geographic Travel Planning Areas (TPAs) for direct and indirect impacts, and the entire Forest for analysis of cumulative effects. These spatial scales were chosen because they represent logical units for evaluating route-by-route travel uses and seasonal restrictions, by alternative. Further, TPAs are of an adequate size to represent the large home range area typically used by wolverines. TPAs were not necessarily defined by ecological boundaries such as topographic and/or hydrologic features, but rather were identified based on existing travel management patterns. For example, wilderness and roadless areas were identified for some TPAs, while areas popular for motorized recreation made up others. Ecologically defined units are generally used for wildlife analyses; however, the wolverine is a habitat generalist, and it is highly likely that human use patterns influence wolverine

habitat selection to a degree equal to or greater than vegetative patterns or other biophysical conditions on the landscape. Although TPAs were the primary spatial scale assessed for direct and indirect effects, a forest-wide summary was used for comparing overall impacts by alternative, and was also useful in evaluating relative distribution of impacts by alternative.

The Gallatin Forest boundary, including private and other jurisdictional inholdings, forms the analysis area for cumulative effects. All travel management decisions made through this process would be specific to routes and areas within the forest boundary. Wolverines have tremendous dispersal capabilities. While it is recognized that wolverines are wide-ranging animals with individuals known to travel both within and well beyond the Gallatin Forest boundary, we have determined that evaluating past, present and reasonably foreseeable future actions within the forest boundary provides sufficient information for the decision-maker to reasonably put the various Travel Management Alternatives into context regarding potential impacts to wolverines. Given the documented home range sizes for adult wolverines in Montana, land within the Gallatin National Forest boundary (roughly 3,305 mi^2) contains sufficient area to provide enough suitable habitat to allow for multiple wolverines to establish home ranges fully within the forest boundary. Although adult resident animals tend to maintain home ranges smaller than the entire area covered by the forest boundary, there is evidence that considerable movement and exchange occurs within and between established home ranges within the forest boundary (Cegelski et al. 2003, Inman et al. 2003), particularly by breeding males and dispersing juveniles.

According to Knight and Gutzwiller (1995:51) there are four primary ways in which human activities can impact wildlife: habitat modification, disturbance, exploitation and pollution. These categories fit well to the scenario of potential impacts of travel management on wolverines, so will be used in this discussion.

Habitat Modification

Habitat modification results from the initial development of travel facilities such as roads and trails, because of improper use such as riding off-trail or from substandard facilities and/or natural events that collectively result in erosion, slumps, etc. Habitat modification is typically an indirect effect of travel management decisions. Allocation of existing facilities to various types of travel uses is the primary function of the travel management process. Most habitat modification associated with existing roads and trails has already occurred. However, maintenance or modification of existing facilities would be required to bring some areas up to standard for various uses, and some new routes are proposed in some of the Travel Plan alternatives. Major modifications and new construction would require separate, site-specific effects assessments so effects due to habitat modification from future projects will not be addressed here.

Permanent modification of wolverine habitat from existing travel facilities occurs primarily because of continued habitat fragmentation and absence of security cover associated with the presence of road and trail corridors through forested wolverine habitat. Forest roads and trails do not pose a barrier to movement for wolverines, and most roads and trails through forested habitat have forested cover nearby. Therefore, the direct and indirect effects of habitat modification due to fragmentation associated with travel infrastructure on the Forest do not pose significant impacts to wolverines in any TPA, nor do the impacts differ considerably among alternatives. Travel management may also

contribute indirectly to habitat modification through the spread of noxious weeds, which are often dispersed along roads and trails. Noxious weed infestations can alter the composition of native vegetation, which can then influence the habitat and thus the availability of wolverine prey species.

In winter, human travel can result in modification of wolverine habitat through snow compaction. Wolverines are well adapted to travel in deep snow conditions, since their proportionately large feet distribute their weight and allow for buoyancy (Hash 1987). This adaptation may provide wolverines with a competitive foraging advantage over some other predators or scavengers in winter. Snow compaction caused by human travel could provide better access to wolverine winter foraging habitat for potential competitors such as coyotes (*Canis lutrans*) and bobcats (*Lynx rufus*). This theory has been postulated for potential impacts to Canada lynx resulting from snow compaction (Buskirk et al. 2000:94), but empirical data are not yet available to prove or disprove this theory.

Snow compaction resulting from human travel could also indirectly affect wolverines through impacts to prey species. Many small mammals utilize the subnivian (under the snow) environment for security cover and thermal regulation in winter. Several authors (Jarvinen and Schmid 1971, Neumann and Merriam 1972, Schmid 1972, Boyle and Samson 1985) have reported adverse impacts to small mammal populations resulting from snow compaction associated with snowmobile use.

Disturbance

Disturbance is the primary mechanism by which travel management decisions are likely to have impacts on wolverines. The fact that wolverines are habitat generalists with the theme of remoteness from humans and human development (Banci 1994:100) implies that wolverines are highly sensitive to human disturbance. Disturbance from human activities can affect wolverines in a number of ways. Potential biological responses include elevated heart rate and respiration, increased blood sugar levels, increased blood flow to skeletal muscles and a corresponding decrease of blood flow to the skin and digestive organs (Knight and Gutzwiller 1995:95). These responses all occur in preparation for what Cannon (1929) coined as the "fight or flight response." These reactions pose an energetic cost to animals at times of critical energy deficiencies, such as during winter or food shortages, and could have serious health consequences for individual wolverines.

Behavioral reactions to disturbance from humans could result in displacement from familiar territories, security cover and foraging opportunities. Wolverines choosing to flee from human intrusions may become more vulnerable to altercations with other predators. This situation should be rare, since wolverines typically occupy large home ranges and should be able find familiar and secure areas for retreat within their home range. Displacement effects due to human disturbance would likely have the greatest impacts on juvenile and subadult animals that have not yet established secure home range territories.

Human access into high elevation alpine habitats in summer could potentially disrupt normal behavioral patterns of breeding pairs or family groups of wolverines (Banci 1994:110). Disturbance that results in displacement of potential mates away from each other, or separation of young from their mothers could influence wolverine reproduction and survival rates.

Displacement from potential foraging opportunities could occur, but would not likely have significant impacts. Wolverines are considered opportunistic omnivores in summer and primarily scavengers in winter (Banci 1994:113). Since most wolverine food sources are stationary, if a wolverine was displaced from a feeding opportunity, the food source would likely still be there when the wolverine returns. Although not considered skilled hunters, wolverines are capable of direct predation on other animals, so there is potential for human disturbance to foil a predatory attack.

Disturbance effects are most likely to have adverse impacts on wolverines during winter; a critical time period since weather conditions are more extreme, food sources may be limited, thermoregulatory demands are high and reproductive females have the added energetic demands of developing fetuses, giving birth and nursing kits (Inman et al. 2003:1). Human disturbance during this challenging time could result in increased energy expenditures due to unnecessary movement to avoid the disturbance, and/or decreased energy intake if foraging is interrupted. These conditions could have negative impacts on wolverine survival and reproductive rates, which could affect the population.

Disturbance impacts from winter travel management could have significant effects on reproductive female wolverines. Although healthy adult female wolverines are capable of annual reproduction, most studies report that not all reproductive age females produce young each year (Hornocker and Hash 1981, Magoun 1985, Banci 1987, Banci and Harestad 1988, Persson 2003, Inman et al. 2003). Banci (1994:105) concluded that poor nutritional status of some females at the onset of denning season, coupled with high energetic demands of fetal development and lactation, are primary causes of reproductive failure. Inman et al. (2003:1) suggest that the energetic costs of reproduction are so high that limited energetic availability influences the yearly reproductive capability of individual females and thus overall reproductive capacity for the population.

Additional stresses induced by human disturbance during the denning season could result in reproductive failure for individual wolverines. Magoun and Copeland (1998:1316) reported that although female wolverines showed site fidelity to natal den sites, they readily abandoned maternal den sites and moved kits in response to human disturbance. Maternal den abandonment could result in relocation of kits to less suitable sites, where they may be more vulnerable to exposure, predation or other threats (Pulliainen 1968), and could therefore influence survival rates.

Exploitation

Exploitation is an indirect effect of travel management in that roads and trails are used to access the National Forest for harvesting animals. Wolverine harvest is legal in Montana under a limited fur trapping season. Wolverines are vulnerable to trapping with baits, due to their nature as scavengers. Their attraction to baits and long-distance movements in search of food increase the probability of wolverines encountering traps, even in remote locations (Hash 1987). Harvesting animals for fur obviously results in direct mortality and can have significant effects on populations. Over most of its distribution worldwide, trapping and hunting account for the largest proportion of known wolverine mortalities (Banci 1994:108). Krebs and co-authors (2004:2) summarized data from wolverine studies in North America and compared survival rates between trapped and untrapped

wolverine populations. Their study showed that survival rates were considerably lower (<0.75 for all age/sex classes) in trapped populations than in untrapped (>0.84 for all age/sex classes). Further, they concluded that trapping mortality was additive rather than compensatory, because natural mortalities in wolverine populations occurred independent of whether harvest was allowed.

Impacts from exploitation led to the near extirpation of wolverines from Montana by 1920 (Newby and Wright 1955:248). Due to apparent recolonization by animals dispersing from Canada (Newby and McDougal 1964:485), Montana is now considered to support the most viable population of wolverines in the contiguous United States (Hornocker and Hash 1981:1287). Montana is the only state in the lower 48 to maintain a legal harvest of wolverines. The trapping season in Montana is limited to one wolverine per trapper per season, and the season is relatively short (December 1 through February 15, annually). A few wolverines are harvested from the Gallatin National Forest each year (N. Anderson, Montana Department of Fish, Wildlife and Parks, personal communication).

Travel management can also have indirect effects through exploitation of wolverine prey species. Hunters account for a large proportion of recreation user days on the Forest. Hunting can alter the behavior, distribution and population structure of game species (Knight and Gutzwiller 1995:53). Wolverine population persistence appears to be related to diverse and abundant big game populations (Hornocker and Hash 1981:1296). Maintaining sustainable populations of big game is a primary objective of Montana Department of Fish, Wildlife and Parks personnel for establishing annual hunting quotas. Copeland (1996:104) reported that animals wounded or killed, but not retrieved by big game hunters, provided a winter food source for wolverines in Idaho.

Pollution

Wolverines could be indirectly affected by pollution left behind by humans traveling on National Forest lands. Exhaust from motorized vehicles could affect wolverines through contamination of air and/or water, although such impacts have not been documented and are considered unlikely due to the wolverine's tendency to avoid concentrated human use areas. Refuse left behind by recreationists has greater potential for adverse effects on wolverines. Due to their scavenging nature, wolverines are likely to be attracted to food or garbage left by humans. Hornocker and Hash (1981:1299) referenced wolverine raids on trap lines, food caches, camps and cabins, while Banci (1994:101) reported evidence of wolverines feeding at garbage dumps in Canada. This tendency for wolverines to take advantage of human food sources in the past was at least partly responsible for unregulated hunting and trapping seasons, which resulted in drastic reductions in the wolverine's historic range of occupation (Hash 1987). Consumption of human foods and refuse could harm wolverines through ingestion of packaging materials such as metal, glass and plastic.

Comparison of Impacts by Alternative

Effects to wolverines caused by human travel on National Forest System lands would differ among the seven alternatives evaluated for this Travel Plan. Road and trail facilities and associated summer use have the potential to affect wolverines through habitat alteration and disturbance impacts. Winter use can affect wolverines through disturbance and/or displacement in reproductive denning habitat, potential for trapping mortalities, and general winter disturbance factors.

Summer Access - Alternative Comparison by TPA

Roads and trails provide human access into wolverine habitat. Access route densities are considered to reflect habitat modification impacts, as well as potential for disturbance, exploitation and pollution. Multiple studies have shown that forest trails and unpaved secondary roads, which account for the vast majority of the Forest Transportation System, have little affect on wildlife movement (Forman et al. 2003:131).

Non-motorized use can impact wolverines through disturbance effects. Since non-motorized use is not restricted to designated routes under any alternative, it is difficult to quantify, although it is likely that the vast majority of such use occurs on trails. Information is very limited regarding non-motorized impacts to wolverines from summer use, and there is no available science that provides guidance on how to quantify effects of non-motorized use on wolverines. For analysis purposes, non-motorized route densities were evaluated for designated Wilderness TPAs, since these areas contain much of the best quality wolverine habitat on the Forest, and also because only non-motorized use is allowed. The five Wilderness TPAs vary in non-motorized route density from a low of 0.4 mi/mi^2 in the Absaroka-Beartooth Plateau unit to a high of 1.0 mi/mi^2 in the Lee Metcalf Spanish Peaks unit. The other three Wilderness TPAs include the Lee Metcalf Hilgard and Monument units at 0.6 mi/mi^2 each, and the Absaroka-Beartooth Wilderness TPA at 0.7 mi/mi^2. Trail densities for each Wilderness TPA remain the same across all alternatives. Higher route densities present greater potential for disturbance impacts.

Motorized route densities were also assessed for potential disturbance effects on wolverines. Rowland and coauthors (2003) evaluated models for wolverine habitat in the northwestern United States and concluded that road densities were a reasonable proxy for human disturbance relative to wolverine occurrence on the landscape. A model developed for the Interior Columbia River Basin found wolverine occurrences to be distinguishable between low road densities (<= 0.44 km/km^2 or <= 0.7 mi/mi^2) and moderate road densities (from 0.45 to 1.06 km/km^2 or from 0.8 to 1.7 mi/mi^2). This model did not show a distinction in wolverine occurrences from moderate to high (> 1.06 km/km^2 or >1.7 mi/mi^2) road densities (Rowland et al. 2003:102). Another model for the Rocky Mountain region (Caroll et al. 2001) found that predicted wolverine occurrences declined when road densities exceeded 1.7 km/km^2 (2.7 mi/mi^2).

Using these apparent break points (low<= 0.7 mi/mi^2, moderate from 0.8 to 2.7 mi/mi^2, and high >2.7 mi/mi^2), comparisons were made between TPAs by alternative to present possible differences in human disturbance potential under various travel management scenarios. All roads that could potentially receive any type of motorized use at some time of the year (private roads, administrative roads and project roads and roads open for public use) were included in density calculations. Trails open to motorcycles and/or ATVs were included in motorized route density calculations, under the assumption that motorized access has the same disturbance effect on wolverines regardless of the vehicle used. Figures 3.22.1 through 3.22.7 show summer motorized route densities by TPA for all alternatives.

Under Alternative 1 (existing condition), TPAs with high motorized route densities (> 2.7 mi/mi^2) include the Bangtails, Bridger Canyon, Ibex and Yellowstone. These areas contain considerable amounts of private land and are in close proximity to state and/or federal highways relative to other

TPAs. Wolverines are likely to under-utilize habitat in areas with high levels of motorized use, but may still occasionally travel through such areas. The only TPAs with low motorized access route densities (<= 0.7 mi/mi^2) include the Wilderness Areas (AB Wilderness, AB Plateau, LM Spanish Peaks, LM Hilgards, LM Monument), Cherry Creek and Sawtooth. These areas are most likely currently providing relatively secure habitat for wolverines. All other TPAs are in the moderate (from 0.8 to 2.7 mi/mi^2) motorized route density category under this alternative. Moderate levels of motorized use could affect spatial and temporal patterns of wolverine use within these TPAs.

For analysis purposes, Alternative 1 assumes that off-route OHV travel is allowed unless otherwise prohibited with area closures, even though the Montana/Dakota OHV decision of January 2001 currently prohibits such use. Prior to the OHV decision, off-route motorized use was probably commensurate with route density across the Forest. However, some TPAs with moderate route density that received considerable off-route use in the past and still have numerous user-built trails, such as Bear Canyon and Gallatin Roaded, would be expected to have similar wolverine occurrence as TPAs with high route densities under the scenario where off-route travel is allowed.

Under Alternative 2, the major change from Alternative 1 is that off-route motorized travel is prohibited. Most wild animals have a higher tolerance for human activities that are predictable (Knight and Gutzwiller 1995:72). Restricting motorized use to designated routes makes travel impacts much more predictable, and animals can either avoid areas with high-use routes, or use these areas at a time when human use is at the lowest levels, as on week days, at night or during seasons of low human use. Under this alternative, TPAs such as Bear Canyon and Gallatin Roaded would be expected to receive motorized use more in line with moderate route densities than high densities, and the Cabin Creek TPA would drop from moderate to low motorized route density. The Bear Canyon TPA is important for maintaining habitat connectivity for north-south movement between the Madison/Gallatin ranges and the Bridgers/Bangtails, continuing north in the Rocky Mountains all the way to Canada. Habitat connectivity in general is important to wildlife, and north-south connections are key to species such as wolverines, since Canada may still be providing a source population for wolverines in the United States (Banci 1994:122). The Cabin Creek TPA provides important habitat for wolverines in the high alpine basins, and provides habitat connectivity between the Monument and Hilgard Units of the Lee Metcalf Wilderness Area.

Under Alternative 3, the same TPAs are at high route densities as under Alternatives 1 and 2 (Bangtail, Bridger Canyon, Ibex, Yellowstone), but route densities in the West Bridgers South, Gallatin Crest and Gallatin River Canyon drop from moderate to low levels. The Gallatin Crest and to a lesser extent the West Bridgers South TPAs provide the high elevation alpine habitat selected by wolverines in summer. Lowering motorized route densities in these areas could potentially increase habitat utilization by wolverines. The West Bridgers South TPA is an important area for maintaining suitable travel/dispersal routes for wolverines. Managing for low road density in this TPA could help offset some negative impacts from high road densities in the adjacent Bridger Canyon TPA.

In Alternative 4, the number of high route density TPAs would decrease from four to three. This alternative includes route closures that would change the Yellowstone TPA from high to moderate route density, although the change is slight (2.8 to 2.7 mi/mi^2), leaving this TPA on the borderline between moderate and high. Also, under Alternative 4, three more TPAs (West Bridgers North,

East Crazies and East Boulder) would convert from moderate to low route densities. All three of these TPAs contain high alpine habitat, but perhaps more importantly, this alternative would significantly increase the proportion of low motorized route density TPAs in the northern portion of the Forest; i.e. in the Bridger and Crazy Mountain Ranges. Managing suitable travel habitat in these mountain ranges is important for maintaining habitat connectivity and gene flow with the Belt Ranges and Rocky Mountain Front Range to the north.

While wolverines are still known to occur in the Crazy Mountain Range, they are considered genetically distinct from other wolverines on the Forest, and are more closely related to animals found in the Little Belt Mountains to the north. This factor indicates that dispersal of animals between the Crazy Mountains and elsewhere on the Gallatin is occurring at very low levels. Decreasing motorized route densities in the East Crazy TPA would likely improve habitat utilization by resident wolverines, but may not noticeably improve wolverine dispersal between the Crazy Mountain Range and elsewhere on the Forest. For one thing, the Crazy Mountains are geographically separated by greater distances than any other area on the Forest. In addition, cities, major roads and agricultural development in lowland valleys are the most likely factors influencing dispersal and thus genetic structure of wolverine subpopulations in Montana (Cegelski et al. 2003:2911, 2914).

Under Alternative 5, the number of TPAs with high motorized route densities would be reduced down to two (Bangtails and Bridger Canyon). Elimination of motorized routes in the Ibex TPA would change route density from high to moderate. Again, the change is slight and route densities for the Ibex TPA remain at the upper end of moderate at 2.6 mi/mi^2. Alternative 5 would add yet more area to the low route density category, by converting the Deer Creeks, Porcupine Buffalo Horn and Lionhead TPAs from moderate to low route densities. The Deer Creeks TPA is generally lower elevation, warmer, drier habitat than found elsewhere on the Forest, and may not provide high quality summer habitat for wolverines. Porcupine Buffalo Horn and Lionhead TPAs, on the other hand, have many high elevation areas where wolverines could benefit from reduced motorized use levels.

Alternative 6 is similar to Alternative 5, but would add the Taylor Fork TPA to the low motorized route density category (down from moderate). The Taylor Fork area has high quality wolverine habitat in upper basins that currently receive moderate levels of motorized use in summer.

Alternative 7-M is most similar to Alternative 5 in terms of motorized route density categories. The only difference occurs in the Deer Creeks and East Boulder TPAs, where Alternative 7-M would result in moderate route density, while Alternative 5 would maintain these TPAs at low motorized route density. The Deer Creeks TPA is generally lower elevation, warmer, drier habitat than found elsewhere on the Forest, and may not provide high quality summer habitat for wolverines. The East Boulder TPA contains high alpine habitat often selected by wolverines in summer, and is adjacent to the AB Wilderness TPA, which provides the largest contiguous block of high quality, relatively undisturbed, high alpine habitat for wolverines on the Forest.

Summer Motorized - Forest-Wide Summary

A forest-wide summary was used to evaluate overall impacts of the various Travel Plan configurations, as well as to assess the distribution of impacts, by Alternative. Table 3.22.1 summarizes the acreage of low, moderate and high, motorized access route density across the forest. All roads and trails that could receive motorized use at some time of the year were included in density calculations, including those on private or other land ownership within the Forest boundary. Acreages were obtained by adding total acres for each TPA in the low, moderate, and high motorized route density categories.

Table 3.22. 1 Acres and percent of total acreage within the Forest boundary (2,115,205) with low, moderate and high total motorized access route density, by alternative.

Motorized Route Density	Alt. 1 Acres (%)	Alt. 2 Acres (%)	Alt. 3 Acres (%)	Alt. 4 Acres (%)	Alt. 5 Acres (%)	Alt. 6 Acres (%)	Alt. 7-M Acres (%)
Low (<= 0.7 mi/mi^2)	764,773 (36)	819,508 (39)	980,953 (46)	1,150,075 (54)	1,334,028 (63)	1,410,988 (67)	1,225,794 (58)
Moderate (0.8 to 2.7 mi/mi^2)	1,253,888 (59)	1,199,153 (56)	1,037,708 (49)	898,969 (43)	734,586 (35)	657,626 (31)	842,820 (40)
High (> 2.7 mi/mi^2)	96,544 (5)	96,544 (5)	96,544 (5)	66,161 (3)	46,591 (2)	46,591 (2)	46,591 (2)

Under Alternatives 1-3, over half the land base within the Forest boundary would be maintained at moderate to high motorized access route densities, where wolverine occurrence has been predicted to decline. Alternative 4 brings the acreage managed at low motorized route densities to nearly the same proportion as lands managed for moderate to high motorized route densities, while Alternatives 5 and 6 clearly shift the balance with over half the total acreage within the Forest boundary managed at low motorized access route densities. In terms of road density categories across the Forest, Alternative 7-M falls between Alternatives 4 and 5. Alternatives 2 through 7-M would result in lower motorized route density, and prohibit off-route summer motorized travel when compared to Alternative 1 (existing condition). Lowering motorized access route density and restricting motorized use to designated routes is expected to improve habitat utilization by wolverines in areas that may have been under-utilized in the past, due to high levels of human disturbance facilitated by motorized access.

Distribution of low, moderate and high motorized route densities varies among alternatives, with Alternatives 1-3 concentrating low densities in the mid-section of the Forest, moderate densities dominate the south end and moderate to high densities in the north. Alternatives 4 through 7-M spread the distribution of low motorized route densities more evenly across the Forest. Figures 3.22.1 through 3.22.7 show motorized route density distribution across the Forest landscape.

Figure 3.22. 1 Wolverine motorized route density ratings, Alternative 1.

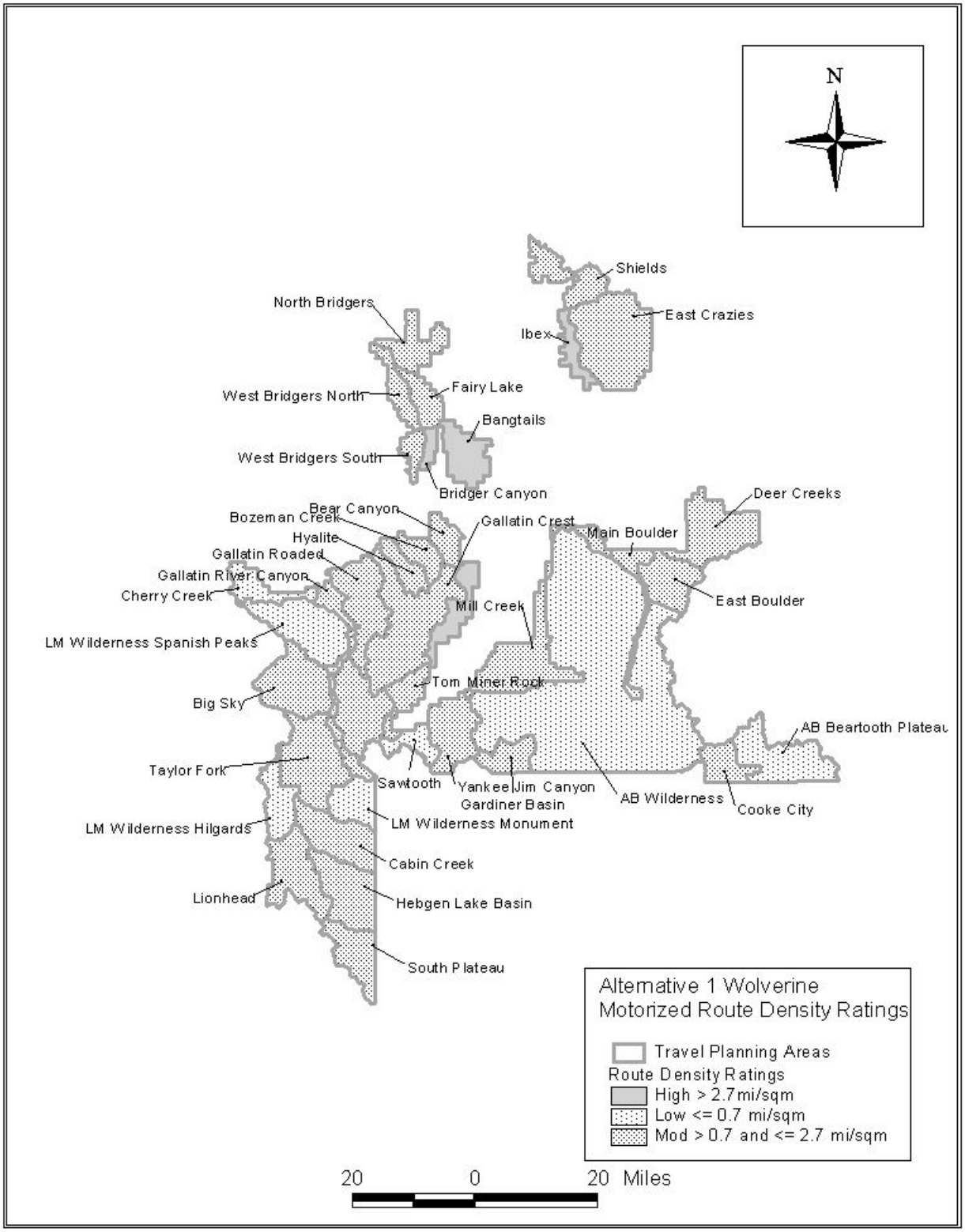


Figure 3.22. 2 Wolverine motorized route density ratings, Alternative 2.

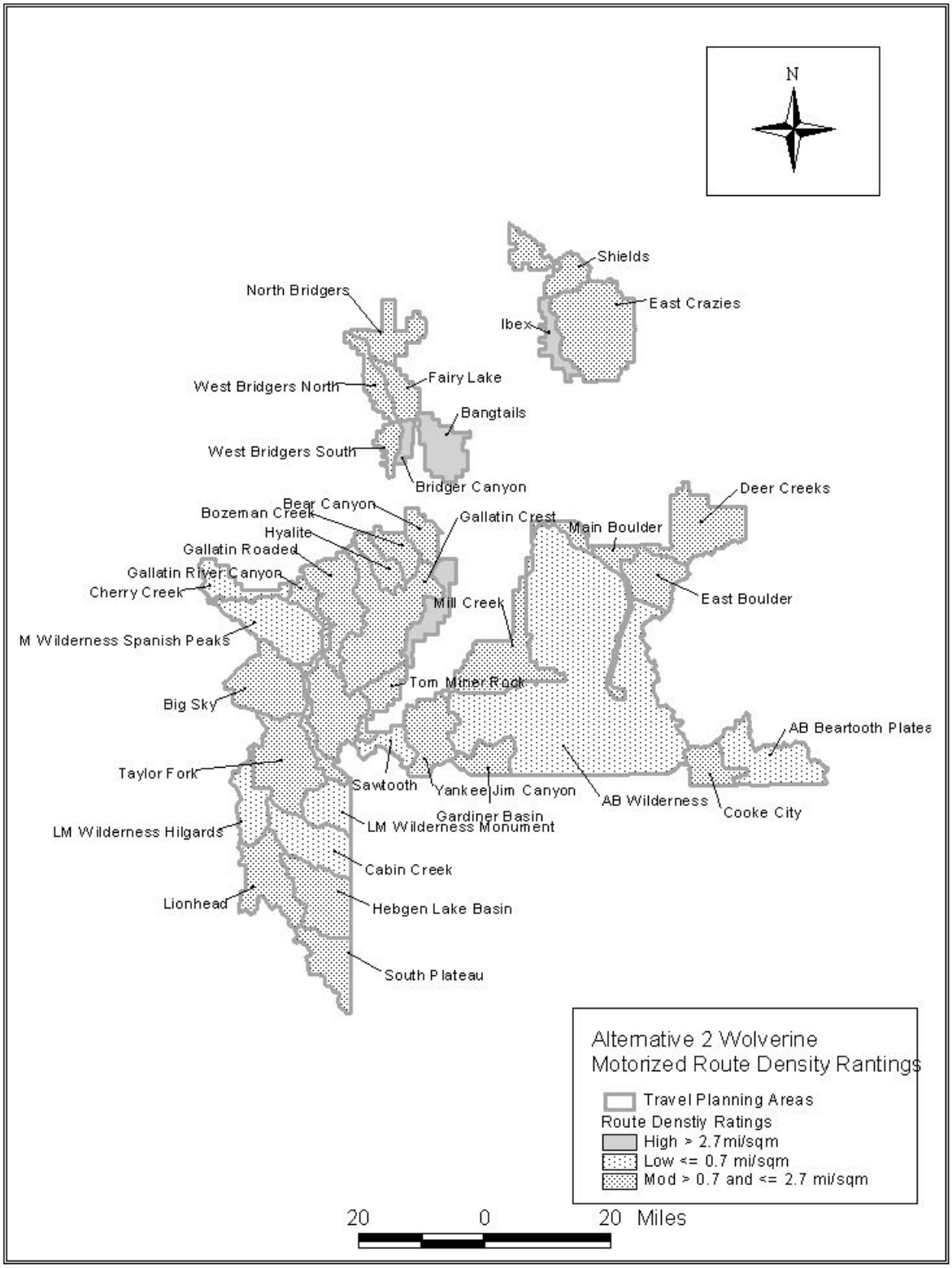


Figure 3.22. 3 Wolverine motorized route density ratings, Alternative 3.

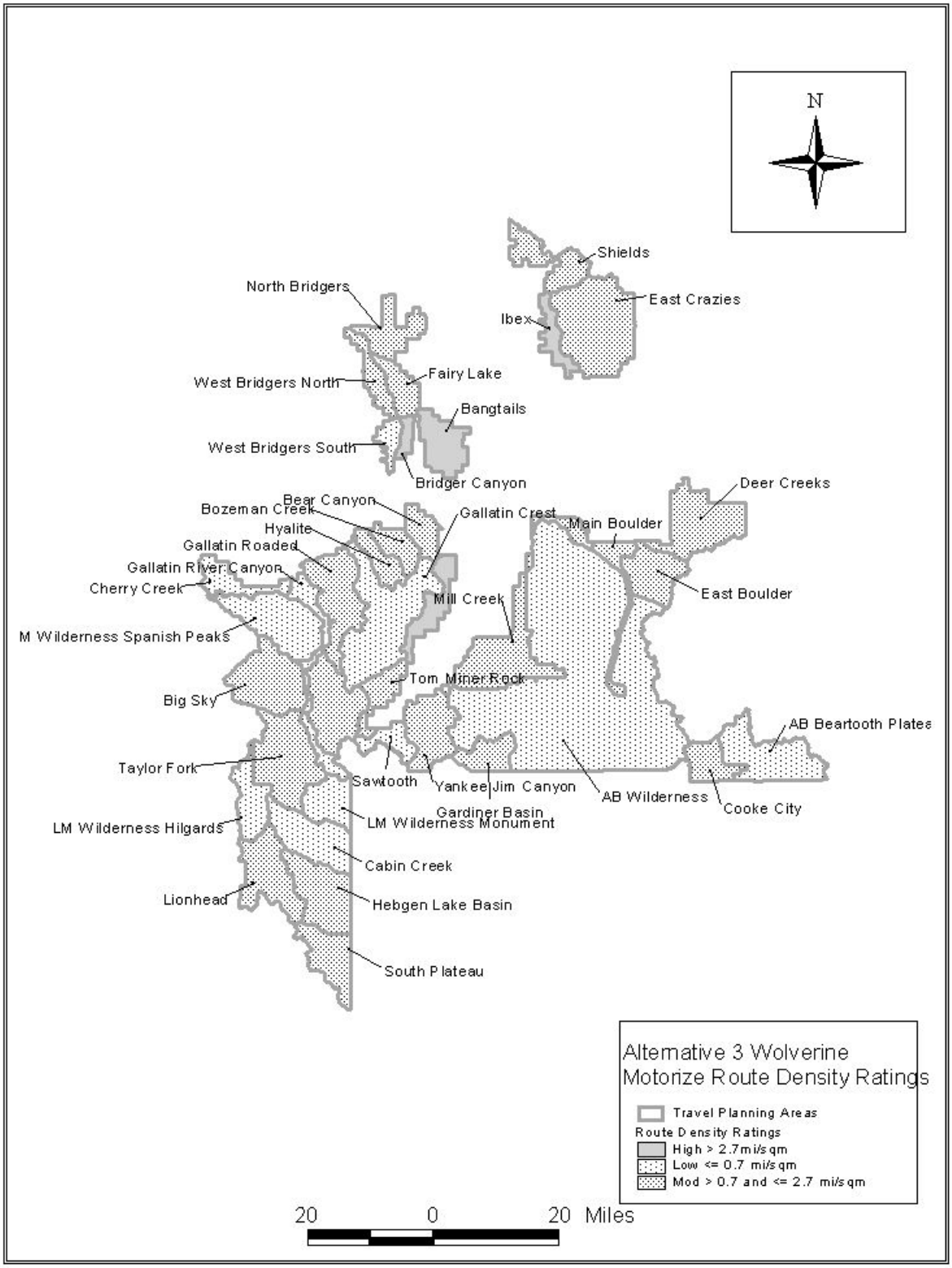


Figure 3.22. 4 Wolverine motorized route density ratings, Alternative 4.

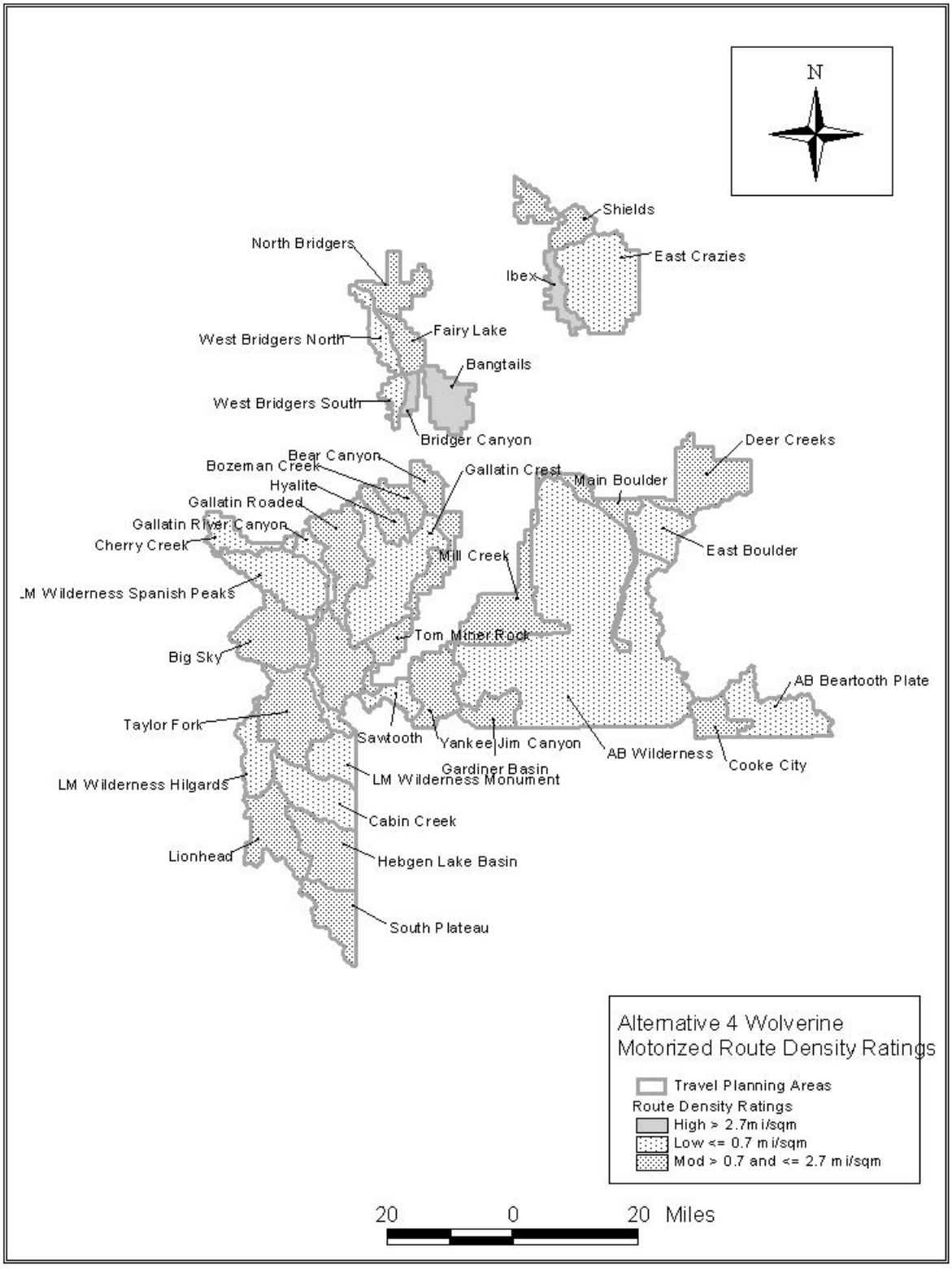


Figure 3.22. 5 Wolverine motorized route density ratings, Alternative 5.

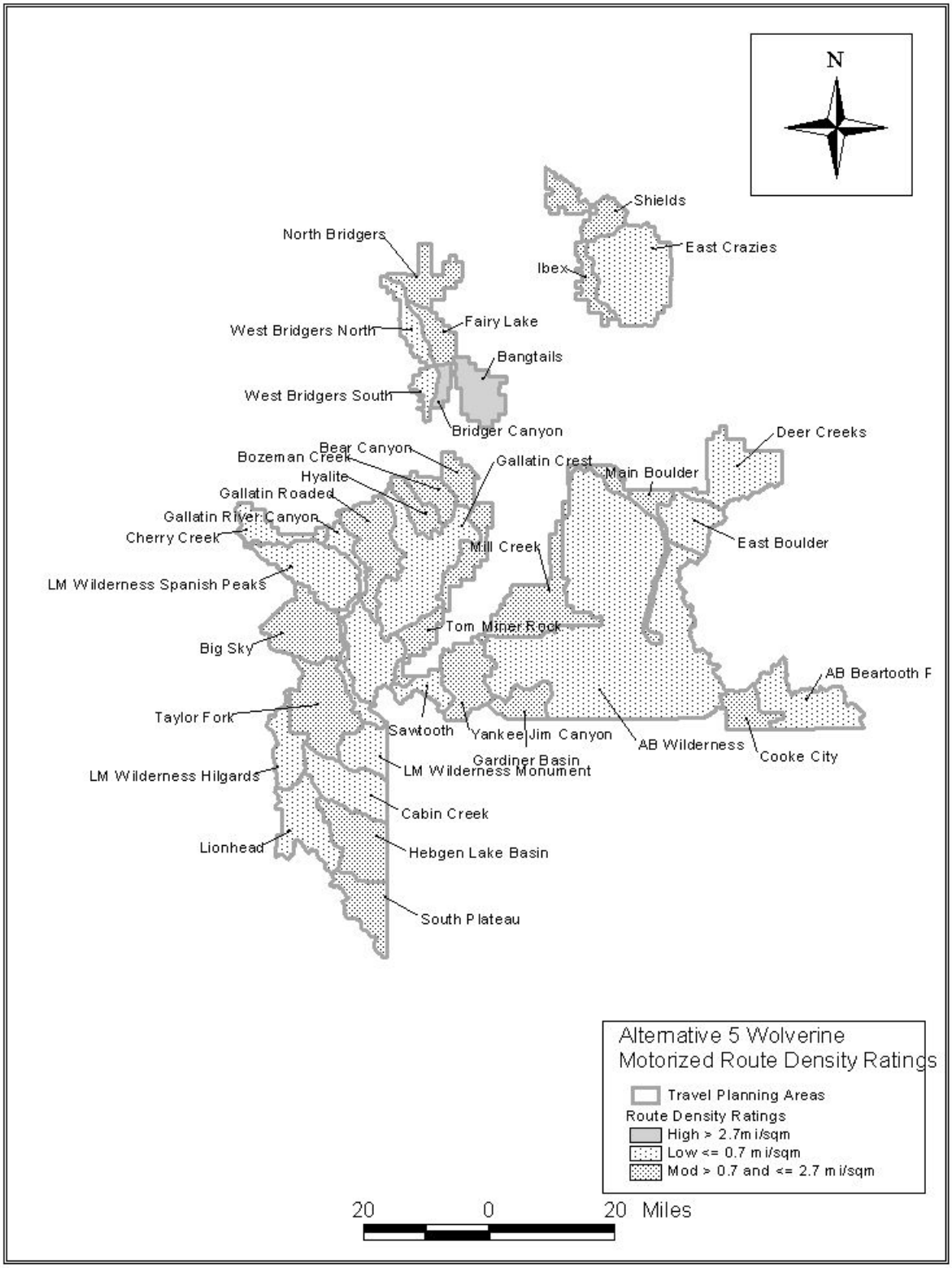


Figure 3.22. 6 Wolverine motorized route density ratings, Alternative 6.

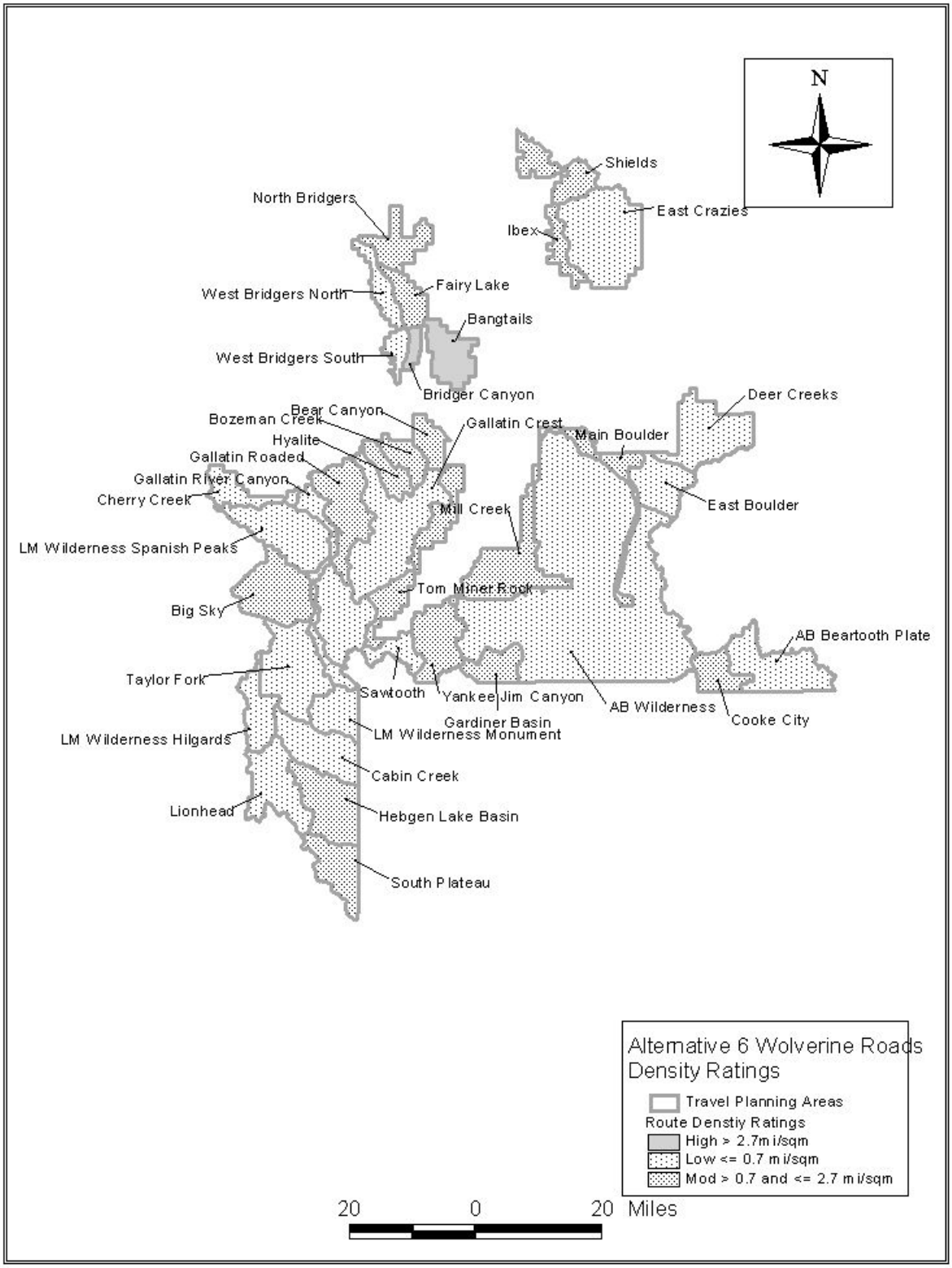
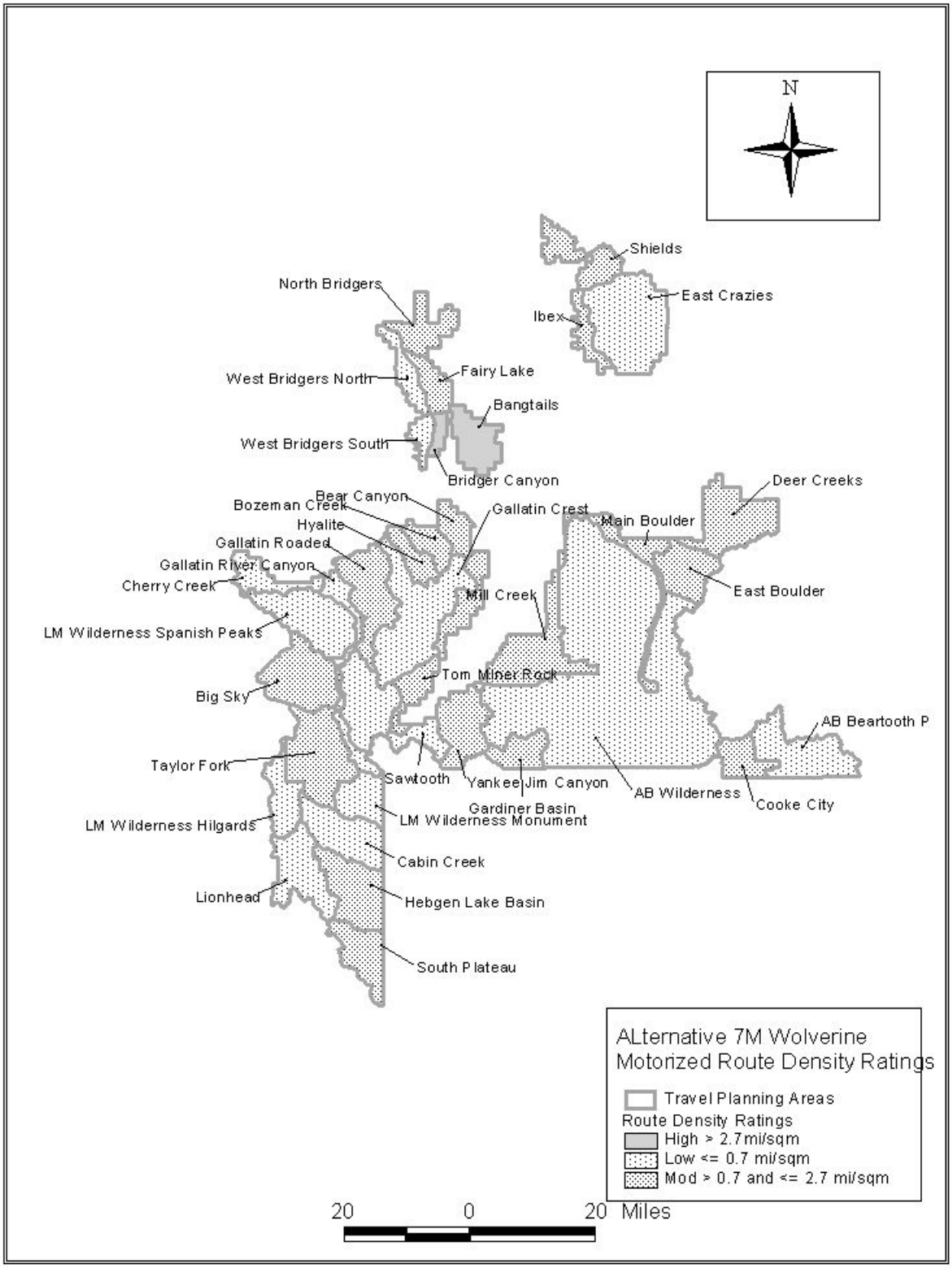


Figure 3.22. 7 Wolverine motorized route density ratings, Alternative 7-M.



Winter - Alternative Comparison by TPA

Winter access is considered to have the greatest potential for adverse impacts on wolverines, since environmental conditions are more extreme, food sources can be limited and energy demands are highest during this time. Winter access into female wolverine denning habitat is considered to have the greatest potential for travel management decisions to influence wolverine reproductive rates. The trapping season for wolverines occurs during winter therefore winter access has the most potential to contribute to direct mortalities of wolverines. In addition, winter access in general has implications for wolverine survival in that it can affect wolverine foraging activities, and deplete critical energy reserves. Winter travel management alternatives were evaluated in terms of providing human access into reproductive denning habitat, as well as winter access in general.

Winter access can affect reproductive wolverines in different ways depending on the timing of use. Disturbance in denning habitat early in the season (December - January) could displace female wolverines from otherwise suitable denning habitat and thus limit the amount of denning habitat available (J. Copeland, USDA Forest Service, personal communication). Disturbance later in the season after kits are born (February - April), could result in den abandonment and potentially impact kit survival. Human access, as facilitated by winter travel management scenarios, is considered to provide the best available approximation of potential for human intrusions into female wolverine denning habitat.

A GIS exercise was used to evaluate relative levels of winter access, as well as differing degrees of habitat protection, by alternative. Designated winter routes and areas open to dispersed snowmobile use were used to compare winter access among alternatives and TPAs. Snowmobile area closures were considered to provide a measure of habitat protection, particularly in wolverine denning areas.

Under Alternative 1, which reflects the current condition, only the five Wilderness TPAs would have 100% of the wolverine denning habitat protected from snowmobile disturbance. However, these TPAs provide over half (53%) of the reproductive denning habitat available on the Forest. Eighty percent of the remaining reproductive denning habitat (outside Wilderness) is located in 10 of the 34 non-Wilderness TPAs (Big Sky, Cabin Creek, East Boulder, East Crazies, Gallatin Crest, Lionhead, Mill Creek, Porcupine Buffalo Horn, Sawtooth, Taylor Fork). Currently, these areas have varying proportions of wolverine denning habitat within snowmobile area closures. The other 24 TPAs outside of Wilderness provide less than 10% of the total wolverine denning habitat on the Forest. Under Alternative 1, only 6% of this remaining denning habitat is located within snowmobile area closures. Table 3.22.2 summarizes the differences in snowmobile area closures relative to protecting wolverine denning habitat, by TPA. Since TPAs vary in size and in the amount of wolverine denning habitat available, the figures in Table 3.22.2 represent protected (i.e., within snowmobile area closure) denning habitat in acres, and as a percent of total denning habitat within each TPA.

Table 3.22. 2 Wolverine denning habitat acres within snowmobile area closures.

Travel Planning Area (Total Acres Denning Habitat)	Alt. 1 Acres (%)	Alt. 2 Acres (%)	Alt. 3 Acres (%)	Alt. 4 Acres (%)	Alt. 5 Acres (%)	Alt. 6 Acres (%)	Alt. 7-M Acres (%)
Wilderness[1] (78,606)	78,606 (100)	78,606 (100)	78,606 (100)	78,606 (100)	78,606 (100)	78,606 (100)	78,606 (100)
Big Sky (5,471)	0 (0)	0 (0)	286 (5)	1,498 (27)	1,498 (27)	1,498 (27)	286 (5)
Cabin Creek (2,431)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2,431 (100)	0 (0)
East Boulder (5,225)	0 (0)	0 (0)	110 (2)	110 (2)	110 (2)	110 (2)	0 (0)
East Crazies (6,845)	0 (0)	0 (0)	4,767 (70)	4,767 (70)	6,845 (100)	4,767 (70)	5,887 (86)
Gallatin Crest (12,154)	2,333 (19)	2,333 (19)	6,957 (57)	10,345 (85)	11,448 (94)	11,448 (94)	9,723 (80)
Lionhead (4,414)	2,925 (66)	2,925 (66)	2,651 (60)	3,210 (73)	3,210 (73)	3,810 (86)	3,018 (68)
Mill Creek (4,827)	328 (7)	328 (7)	328 (7)	328 (7)	1,416 (29)	328 (7)	698 (14)
Porcupine Buffalo Horn (5,115)	1,073 (21)	1,073 (21)	392 (8)	392 (8)	3,711 (73)	3,914 (77)	2,530 (49)
Sawtooth (2,841)	0 (0)	0 (0)	2,683 (94)	2,683 (94)	2,831 (99)	2,841 (100)	2,831 (99)
Talor Fork (6,891)	163 (2)	163 (2)	357 (5)	357 (5)	645 (9)	5,347 (78)	3,038 (44)
All Others[2] (13,817)	788 (6)	804 (6)	3,529 (26)	4,954 (36)	7,287 (53)	5,114 (37)	4,926 (36)

[1]Wilderness = AB Plateau, AB Wilderness, LM Spanish Peaks, LM Hilgard, LM Monument TPAs.

[2]All Others = Bangtails, Bear Canyon, Bozeman Creek, Bridger Canyon, Cherry Creek, Cooke City, Deer Creeks, Fairy Lake, Gallatin River, Gallatin Roaded, Gardiner Basin, Hebgen Basin, Hyalite, Ibex, Main Boulder, Mission, North Bridgers, Shields, South Plateau, Tom Miner Rock, West Bridgers North, West Bridgers South, Yankee Jim,Yellowstone TPAs.

Some area closures allow for snowmobile travel through the area on designated routes. Since most wild animals have a higher tolerance for human activities that are predictable (Knight and Gutzwiller 1995:72), snowmobile use restricted to designated routes is considered less of an impact to wolverines than dispersed use. However, snowmobile use on designated routes through potential denning habitat is considered to have adverse impacts on wolverines.

Alternatives 1-3 each have just 0.2 miles of designated snowmobile route through wolverine denning habitat within a snowmobile area closure. In each of these alternatives, the identified route is in the Porcupine Buffalo Horn TPA. Alternatives 4 and 5 have the same 0.2 miles of designated route in the Porcupine Buffalo Horn TPA plus 0.1 mile in the Cooke City TPA. Alternative 6 eliminates the designated snowmobile routes from wolverine denning habitat in the Cooke City and Porcupine Buffalo Horn TPAs, but adds 0.2 miles in Cabin Creek, 0.1 mile in South Plateau TPA and 2.1 miles in Taylor Fork TPA. Although Alternative 6 shows more snowmobile routes within area closures than other alternatives, this increase is at least partially due to larger area closures rather than increases in designated routes. Alternative 7-M has basically the same routes as Alternatives 4 and 5, but with the addition of 0.3 miles in the Gallatin Crest TPA.

Under all alternatives, some groomed or marked snowmobile routes occur in wolverine denning habitat that is not within area closures. The majority of these routes are located in the Big Sky TPA (2.2 mi in all alternatives) and Taylor Fork TPA (ranging from 0.6 mi in Alt. 6 to 4.2 mi in Alt 3). Although denning habitat near these snowmobile trails is susceptible to disturbance from dispersed snowmobile use as well, groomed and marked routes generally get the highest levels of use and are therefore noteworthy. Impacts to wolverine denning habitat from designated snowmobile routes through areas open to dispersed snowmobile use vary by alternative, with Alternative 6 at the lowest for a total of 5.1 miles, Alternative 5 with 6.9 miles, Alternative 1 and 2 at 7.2 miles, Alternative 4 at 7.9 miles, Alternative 7-M at 8.9 miles and Alternative 3 with the highest at 9.7 miles. These amounts of designated routes are not likely to add measurable effects to wolverine denning habitat in areas already impacted by dispersed snowmobile use.

Non-motorized human access can also impact wolverines at den sites (Magoun and Copeland 1998:1316). Non-motorized dispersed winter use such as backcountry skiing and snowboarding is often facilitated by motorized access; i.e. destination areas are reached by snowmobile. Since it is difficult to quantify this type of dispersed use, it is assumed that impacts from such use are commensurate with levels of snow machine access, and are therefore included in the evaluation of snowmobile access presented above.

Wolverine reproductive den sites are typically associated with high elevation, deep snow conditions. As such, non-motorized human access to denning habitat is more difficult than motorized access, and is facilitated by packed routes. Designated ski trails receive more use than non-designated routes because they are either mechanically groomed or packed by use, which facilitates cross-country travel through deep snow. Therefore, the potential for non-motorized access to impact wolverine reproduction was assessed through an evaluation of groomed or marked cross-country ski routes into wolverine denning habitat. The majority of groomed and/or marked ski routes occur in TPAs that provide a relatively small proportion of wolverine denning habitat. Table 3.22.3 shows the number of miles of groomed or marked ski routes that impact wolverine denning habitat, by alternative for affected TPAs.

Table 3.22. 3 Miles of groomed/marked ski trails in wolverine denning habitat, by alternative.

Travel Planning Area	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7-M
Bangtails	0.3	0.3	0.3	0.3	0.0	0.3	0.0
Big Sky	0.7	0.7	0.8	0.8	0.8	0.8	0.8
Cooke City	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Fairy Lake	0.0	0.0	0.1	0.1	0.0	0.1	0.0
S. Plateau	0.0	0.0	0.2	0.2	0.0	0.2	0.2

As can be seen from Table 3.22.3 above, there are very few groomed or marked ski trails that enter wolverine denning habitat in all alternatives. Alternatives 5 and 7-M have the least impact, with a total of 2.0 miles of designated ski route in wolverine denning habitat, while Alternatives 3, 4 and 6 are identical and have the highest amount (2.6 miles). Alternatives 1 and 2, which most closely represent the existing condition, lie in between with a total of 2.2 miles of designated ski trails in wolverine denning habitat. Under all alternatives, these small amounts of trails, by themselves, are unlikely to have measurable impacts on wolverine denning habitat at the Forest scale.

Winter access also affects wolverines in non-denning habitat. Major impacts are associated with disturbance that could displace wolverines from foraging or resting areas, as well as access for fur trapping. Winter disturbance that results in forced movement of wolverines exerts an energetic cost at a time when energetic efficiency is critical. Fur trapping, when successful, results in direct mortality of wolverines. Even if a wolverine escapes from a trap, the result can be broken teeth and/or bones, which could significantly impair the overall fitness of the animal (Hornocker and Hash 1981:1297). Trapping records were obtained from Montana Fish, Wildlife and Parks for wolverines legally harvested within or near the Gallatin National Forest between 1975 and 2003. During this period, 69 wolverines were taken within the Forest boundary, and an additional 14 were harvested adjacent to, or within a few miles of the Forest boundary. Based on location data from state records, it was determined that of all the wolverines reported taken by fur trappers, only two were at a distance greater than one mile from a route or area open to vehicle or snowmobile use.

Since non-reproductive wolverines are considered habitat generalists in winter, impacts were evaluated by examining general winter access to National Forest lands facilitated by plowed roads, groomed routes and marked winter trails, as well as areas open to dispersed snowmobile use. Little information exists to differentiate how various human winter travel modes might affect wolverines. Therefore, access routes for passenger vehicle, snowmobile and foot were all lumped together to quantify various levels of possible winter disturbance of wolverines. Because TPAs vary in size, evaluating density of access routes facilitated comparison among TPAs for winter access. Areas without snowmobile restrictions were all considered to have potential impacts on wintering wolverines.

Winter access was evaluated as a combination of route density and proportion of land base open to snowmobile use. The Forest Service does not have accurate information regarding winter access (plowed roads or snowmobile use) for private land. Therefore, only National Forest lands were included in calculations of winter route densities and snowmobile use areas. Portions of state and federal highways that cross the Forest boundary were included as plowed road winter access routes.

Although there is wide agreement in the literature that winter access and associated recreation can have adverse effects on wolverines (Hornocker and Hash 1981, Banci 1994, Copeland 1996, Magoun and Copeland 1998, Inman et al. 2003), there is little information available regarding how varying levels of winter use might impact this species. Therefore, for analysis purposes, categories of access route density were considered from the summer access analysis (low<= 0.7 mi/mi^2, moderate from 0.8 to 2.7 mi/mi^2, and high >2.7 mi/mi^2). However, since winter is a much more energetically demanding time, and no TPAs would have high route densities under any alternative using the summer cutoffs, for winter analysis route densities of 0.7 mi/mi^2 or less were considered to have relatively low impact, while densities in excess of 0.7 mi/mi^2 were considered to be higher impact, with more potential for adverse effects.

The literature contains no quantifiable information regarding any apparent breakpoint at which the level of dispersed snowmobile use might begin to have adverse effects on wolverine populations. Assuming dispersed snowmobile use will occur wherever this activity is not restricted, scenarios with more than 50% of the land base (considering Forest Service land only) open to snowmobile use were considered to have potentially high impacts to wolverines. However, it should be noted

that not all areas managed as open for snowmobile use are actually accessible by snow machine. Some areas shown as open for snowmobiling are either terrain limited (e.g. too steep, too rocky, too many trees, too little snow, etc.) or access limited by private land.

Each TPA was evaluated relative to winter route densities combined with proportion of land base open to dispersed snowmobile use for all alternatives. Using a combination of route density and proportion of land base open to snowmobile use, four categories of winter use appeared meaningful for effects analysis: 1) lower route density (<=0.7 mi/mi^2) combined with lower (<=50%) proportion of land base open; 2) higher route density (>0.7 mi/mi^2) combined with lower proportion open; 3) lower route density combined with higher (>50%) proportion open; and 4) higher route density combined with higher proportion open. For analysis purposes, category 1 was considered to have the least winter impacts for wolverines, with progressively greater impacts for categories 2-4.

With the exception of the five Wilderness TPAs, only one TPA, Yankee Jim, is in category 1 with low route density (0.2 mi/mi^2) and lower proportions of area open to snowmobile use (0-40%) under all alternatives. Gardiner Basin is the only TPA that falls in category 2 (higher route density with lower proportion of land open) under all alternatives. Deer Creek, East Boulder, Mill Creek and North Bridger TPAs fall in category 3 (lower route densities with higher proportions open to snowmobile use) under all alternatives. Several TPAs fall in the highest impact category 4, where higher route densities are combined with a higher proportion of land open under all alternatives. These TPAs include: Bangtails, Bear Canyon, Big Sky, Cooke City, Gallatin Roaded, Hebgen Basin, Main Boulder and South Plateau. All other TPAs show at least some variation across the range of alternatives.

Winter access categories are the same under all alternatives for 19 of the 39 TPAs (as described above). There is considerable variation in winter access configuration for the remaining 20 TPAs across the seven alternatives. Notably, Hyalite TPA is in the highest impact category 4 under Alternatives 1 and 2, but falls to relatively lower impact category 2 in Alternatives 3 through 7-M. Likewise, Cherry Creek, East Crazies, Gallatin Crest, Lionhead, Sawtooth and Tom Miner Rock TPAs are all in the moderately high impact category 3 under Alternatives 1 and 2, but are reduced to the lowest impact category 1 in Alternatives 3 through 7-M. Porcupine Buffalo Horn TPA is in the moderately high category 3 for Alternatives 1-4, but is in the lowest category 1 for Alternatives 5 through 7-M. Fairy Lake TPA is in the highest impact category 4 under Alternatives 1-4 and 6, but in the relatively lower category 2 in Alternatives 5 and 7-M. Cabin Creek TPA is in the moderately high impact category 3 for all alternatives except Alternative 5, which is in the low impact category 1. Taylor Fork TPA is in the moderately high impact category 3 for Alternatives 1-5, but in the lowest impact category 1 in Alternatives 6 and 7-M. All of these TPAs contain high quality winter habitat for wolverines and conversion from higher impact winter access categories (3 or 4) to lower impact categories (1 or 2) in these important areas is expected to benefit wolverines. Ibex TPA, with some high quality winter habitat, is the only TPA that really varies across alternatives in terms of winter access category. This TPA is in the lowest impact category 1 only in Alternative 5, in the moderately high impact category 3 in Alternatives 1 and 2 and in the highest impact category 4 in all other alternatives. Figures 3.22.8 through 3.22.12 show winter access categories for each TPA under all alternatives.

Winter - Forest-Wide Summary

Winter access is of primary concern relative to disturbance effects to reproductive females in denning habitat. Most of the literature stressed the importance of providing secure reproductive denning habitat for wolverines (Hornocker and Hash 1981, Hash 1987, Banci 1994, Copeland 1996, Magoun and Copeland 1998, Inman et al. 2003). Secure denning habitat should be well distributed across the Forest. Both male and female wolverines are capable of long-distance movements, but females are more likely to establish home ranges within or near their natal territory. Female wolverines may not occupy otherwise suitable habitat if secure reproductive den sites are not available. Although male wolverines may disperse great distances in search of females during the breeding season, there is no reason for males to occupy habitat where females do not occur. Therefore, a lack of secure reproductive denning habitat that is well distributed across the Forest could lead to fragmented wolverine populations, resulting in a higher probability of inbreeding and ultimately reducing the overall fitness of the population (or subpopulations) and increasing the vulnerability of this species to local extirpations.

Restricting winter motorized transportation makes human access to wolverine denning habitat more difficult, and therefore adds a measure of security in suitable denning habitat. Motorized access restrictions are inherent in designated Wilderness, and are achieved outside of Wilderness using snowmobile area closures. Table 3.22.4 summarizes the acres of wolverine denning habitat in secure areas (e.g. within designated Wilderness or within a snowmobile area closure) Forest-wide. This table also portrays the amount of secure denning habitat as a proportion of the total potential denning habitat available across the Forest, as well as the proportion of secure denning habitat within designated Wilderness. Some area closures contain designated routes on which snowmobiles may travel through the area, but only on the designated route. Therefore, the linear miles of designated snowmobile routes through wolverine denning habitat within snowmobile area closures are also displayed.

Table 3.22. 4 Denning habitat in secure areas (Wilderness, snowmobile closure) by alternative.

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7-M
Acres in Secure Habitat	86,216	86,232	100,666	107,250	117,607	119,628	111,543
% Total Denning Habitat	58	58	68	72	79	80	75
% in Wilderness	91	91	78	73	67	66	70
Miles Designated Routes	0.2	0.2	0.2	0.2	0.5	2.9	0.6

Under all Alternatives, over half of the predicted suitable wolverine denning habitat is in some sort of area closure where snowmobiling is prohibited, unless on a designated route. Alternatives 1 and 2 limit most snowmobile restrictions to designated Wilderness, while Alternatives 3-6 add progressively more area restrictions to dispersed snowmobile use outside of designated Wilderness. Alternative 7-M falls between Alternative 4 and 5 for acres and proportions of secure wolverine denning habitat provided by snowmobile area closures. Alternatives 5 and 6 allow more snowmobile use on designated routes through otherwise secure denning habitat, because more area is closed to dispersed snowmobiling under these two alternatives.

Reproductive denning habitat that is located in areas currently open to dispersed snowmobiling may be under-utilized if human disturbance is persistent during the denning season (Copeland and Whitman 2003:680). Table 3.22.5 summarizes the amount of potential denning habitat that would be open to dispersed snowmobile use under various travel management scenarios Forest-wide. Designated snowmobile routes through denning habitat are again displayed, since designated routes (i.e., either groomed or otherwise managed for snowmobiling) are likely to receive higher levels of use than routes that are open but not necessarily managed for snowmobiling.

Table 3.22. 5 Denning habitat in areas open to dispersed snowmobile use, by alternative.

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7-M
Total Acres Open	62,421	62,405	47,971	41,387	31,030	28,435	37,094
% Total Denning Habitat	42	42	32	28	21	19	25
Miles Designated Routes	7.2	7.2	9.7	7.9	6.9	5.1	8.9

Non-motorized access can also have adverse effects on reproductive wolverines in denning habitat (Magoun and Copeland 1998:1316). Table 3.22.6 summarizes miles of designated cross-country ski trails in wolverine denning habitat across the Forest. The figures are broken out according to whether or not the ski trail is within an area closure for snowmobiles, under the assumption that denning habitat quality may already be impaired in areas where snowmobile use is common.

Table 3.22. 6 Miles of designated ski trails in wolverine denning habitat, by alternative.

Miles	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7-M
Within Area Closures	0.0	0.2	0.4	1.4	1.1	1.4	0.2
Outside Area Closures	2.2	2.0	2.2	1.2	0.9	1.2	1.8
Total	2.2	2.2	2.6	2.6	2.0	2.6	2.0

Winter access and associated recreation can also affect the non-reproductive segment of the wolverine population. Table 3.22.7 summarizes winter access categories considering route densities including plowed roads, groomed and marked snowmobile routes and groomed and marked ski trails, combined with the proportion of land base open to dispersed snowmobile use across the entire Forest, by alternative (Forest Service land only). The table shows acres of Forest Service land in each winter access category and percent of total Forest Service acres (1,850,030).

Table 3.22. 7 Summary of general winter access on Forest, by alternative (NFS land only).

Winter Access Category	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7-M
Category 1: <=0.7 mi/mi^2; <= 50% open	757,116 (41%)	757,116 (41%)	1,056,987 (57%)	1,056,987 (57%)	1,129,955 (61%)	1,245,129 (67%)	1,202,398 (65%)
Category 2: >0.7 mi/mi^2; <= 50% open	40,828 (2%)	40,828 (2%)	97,335 (5%)	97,335 (5%)	105,850 (6%)	91,039 (5%)	88,308 (5%)
Category 3: <=0.7 mi/mi^2; > 50% open	765,049 (41%)	765,049 (41%)	446,101 (24%)	446,101 (24%)	392,210 (21%)	264,255 (14%)	324,528 (17%)
Category 4: >0.7 mi/mi^2; >50% open	287,037 (16%)	287,037 (16%)	249,607 (14%)	249,607 (14%)	222,015 (12%)	249,607 (14%)	234,796 (13%)

For winter access categories, Alternative 1 and 2 are identical, as are Alternatives 3 and 4. Slight variations occur across all other Alternatives (5 through 7-M). In assessing winter access across the forest, the most notable differences between alternatives occur in category 1 (lowest winter impact) and category 3 (higher impact, but not the most impactive). Alternatives 1 and 2 (basically reflective of the existing condition for winter) have less than half the Forest land base in category 1. Under these alternatives, most of the category 1 lands are in designated Wilderness Areas. Only one TPA outside of designated Wilderness, Yankee Jim Canyon, is in category 1 under Alternatives 1 and 2. Alternatives 3 through 7-M all bring the proportion of the Forest in category 1 to over half the land base. Category 3, where lower winter route densities are combined with higher proportions of land open to snowmobile use decreases considerably from Alternatives 1-2 (existing condition) to Alternatives 3 through 7-M. An increase in category 1 coupled with a decrease in category 3 (as indicated for Alternatives 3 through 7-M) is expected to benefit wolverines. Category 2 (higher route densities combined with lower proportions of land open for snowmobile use) and category 4 (greatest impact from high route densities combined with high proportions of land open) both remain relatively stable across all alternatives, and combined represent a relatively small proportion (<20%) of Gallatin Forest lands under all alternatives.

Figures 3.22.8 through 3.22.12 show general winter access category distribution across the Forest for all alternatives.

Figure 3.22. 8 Winter access categories, Alternatives 1 and 2.

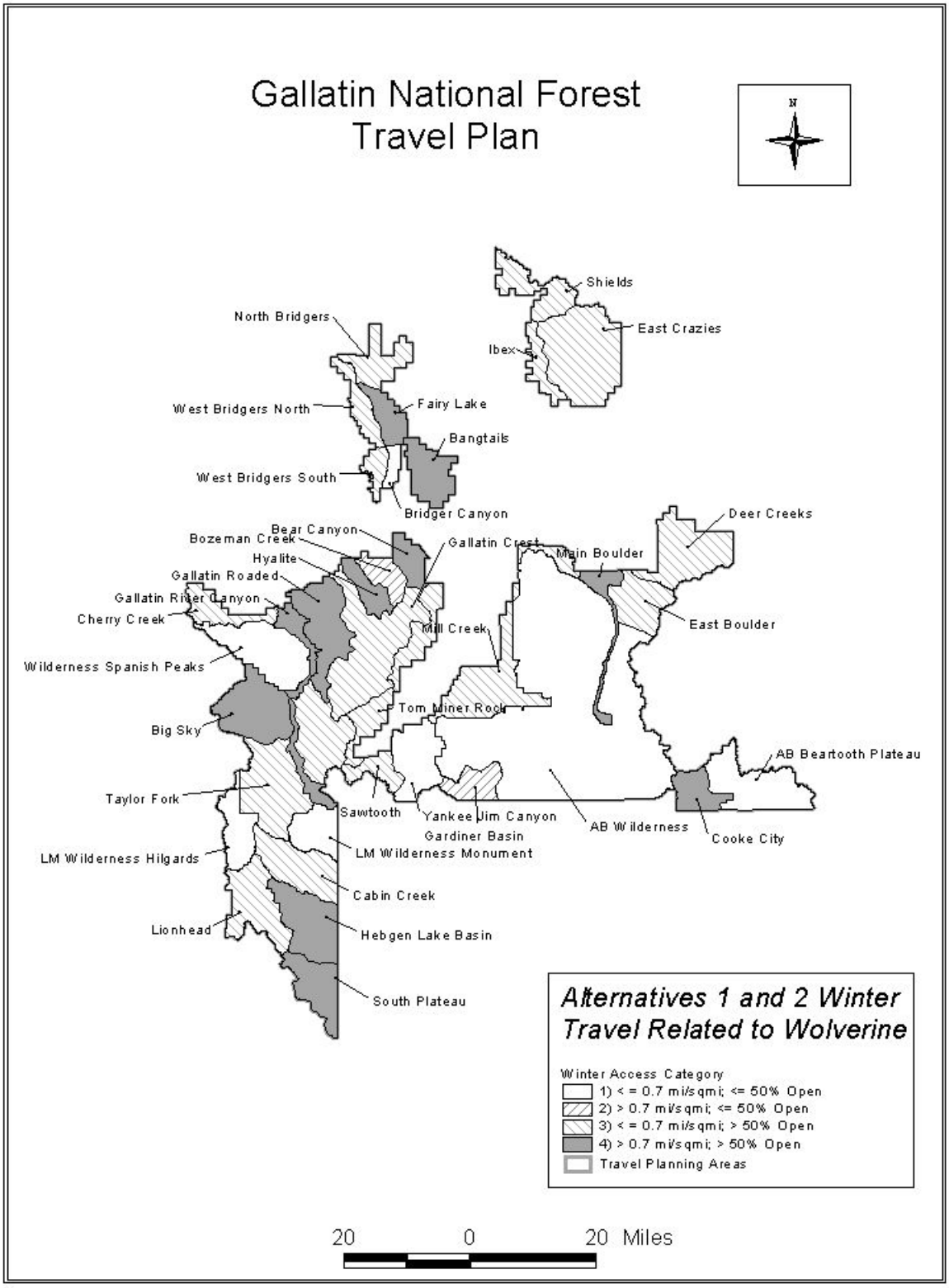


Figure 3.22. 9 Winter access categories, Alternatives 3 and 4.

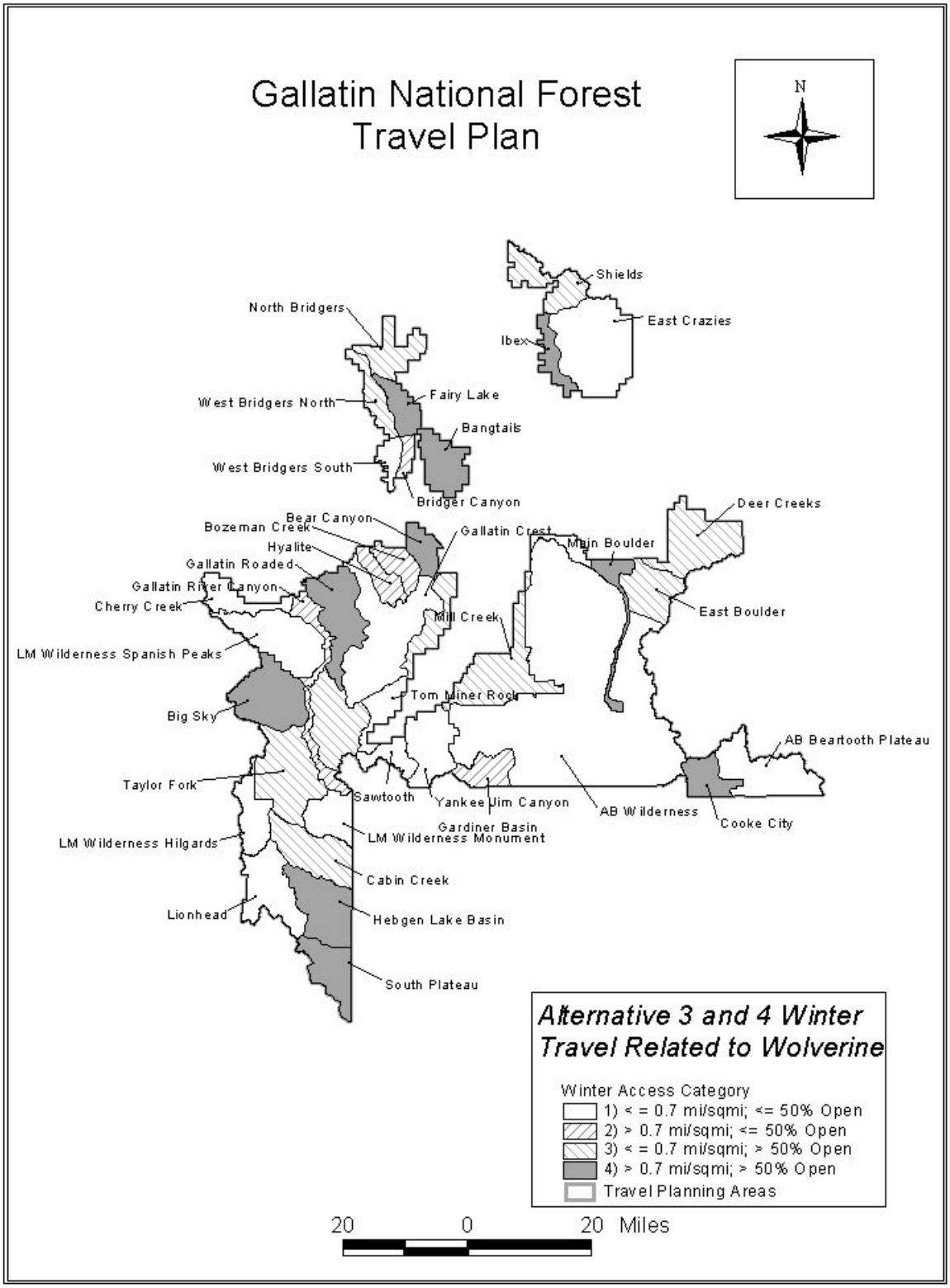


Figure 3.22. 10 Winter access categories, Alternative 5.

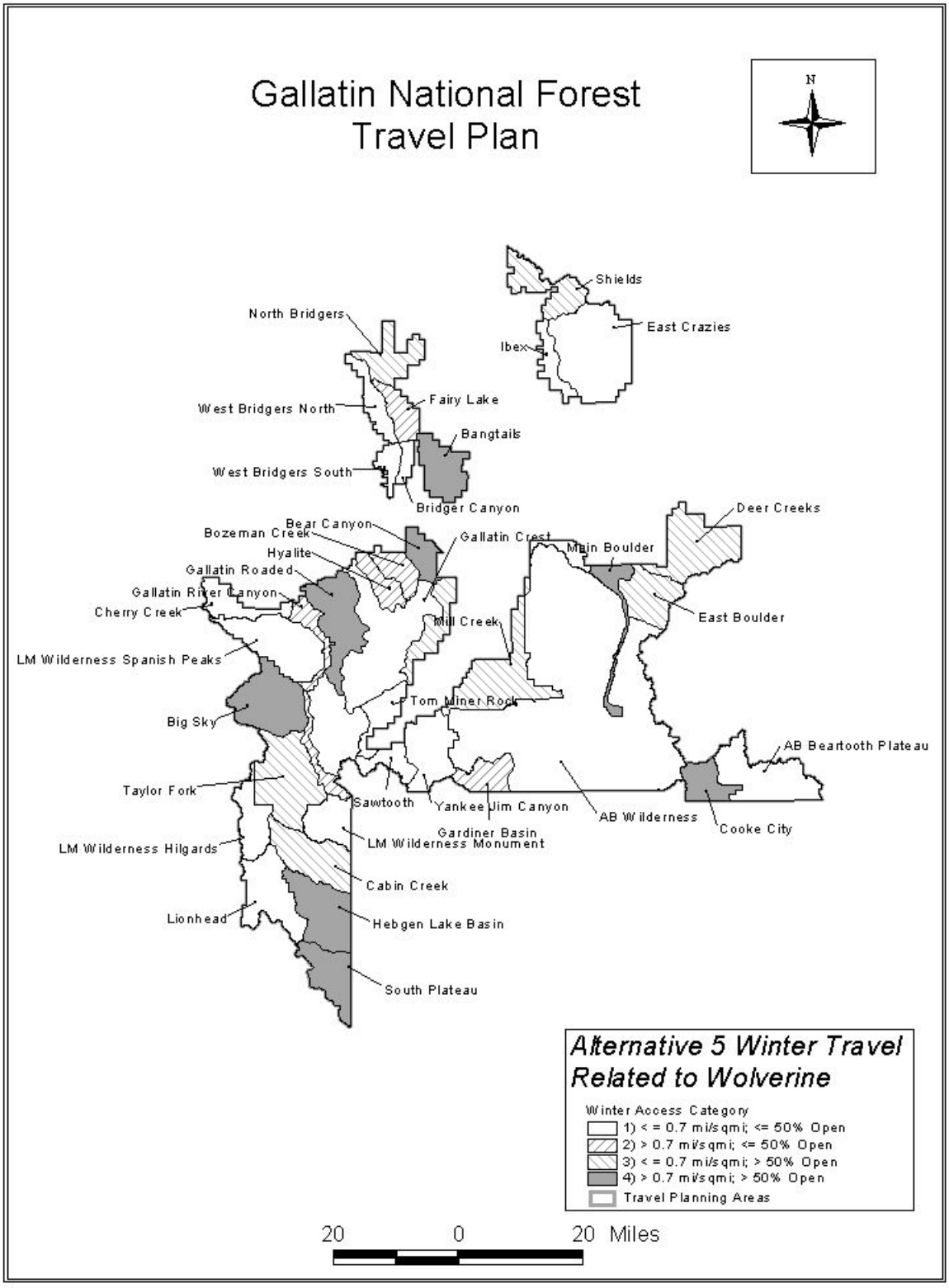


Figure 3.22. 11 Winter access categories, Alternative 6.

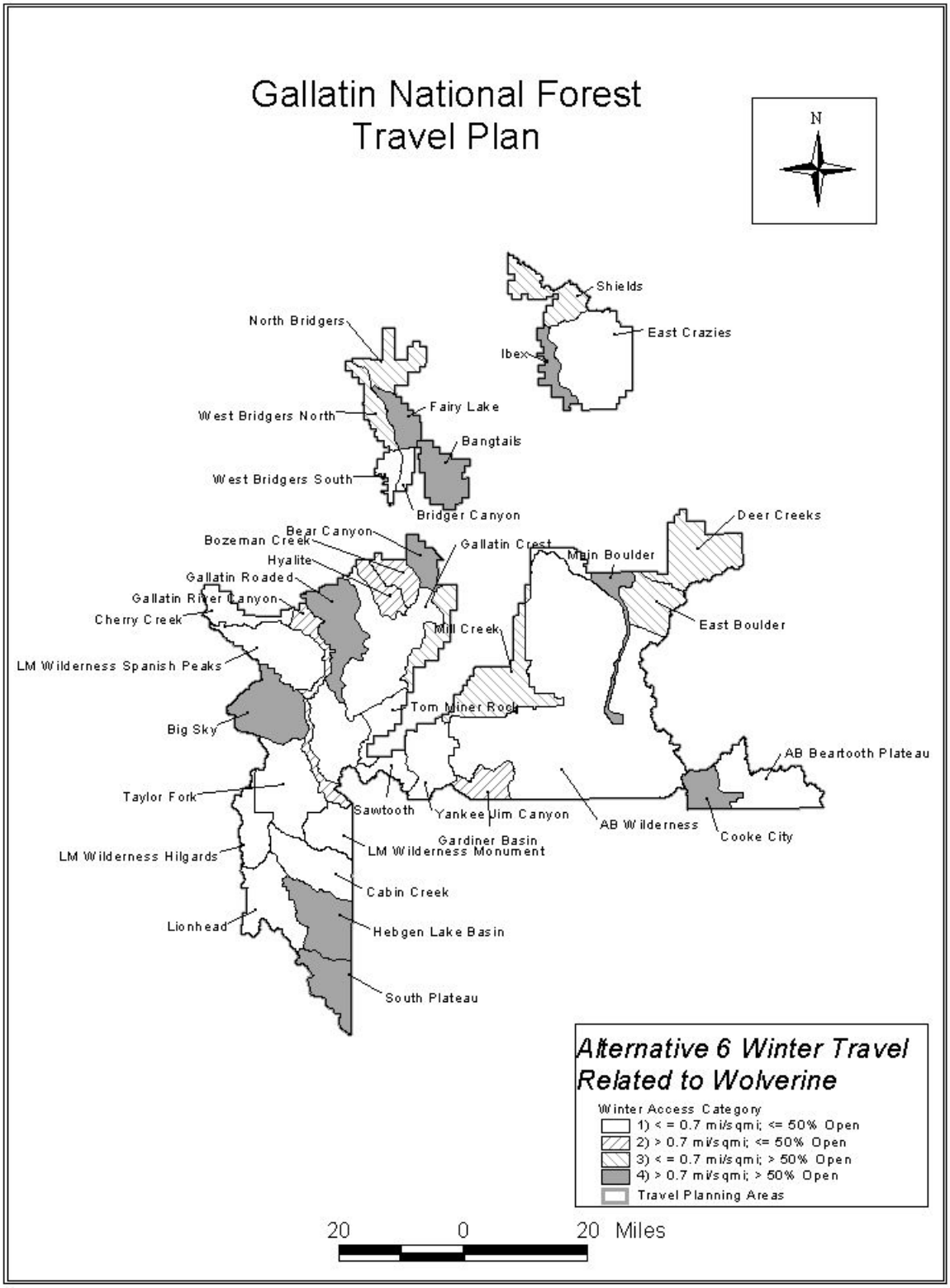
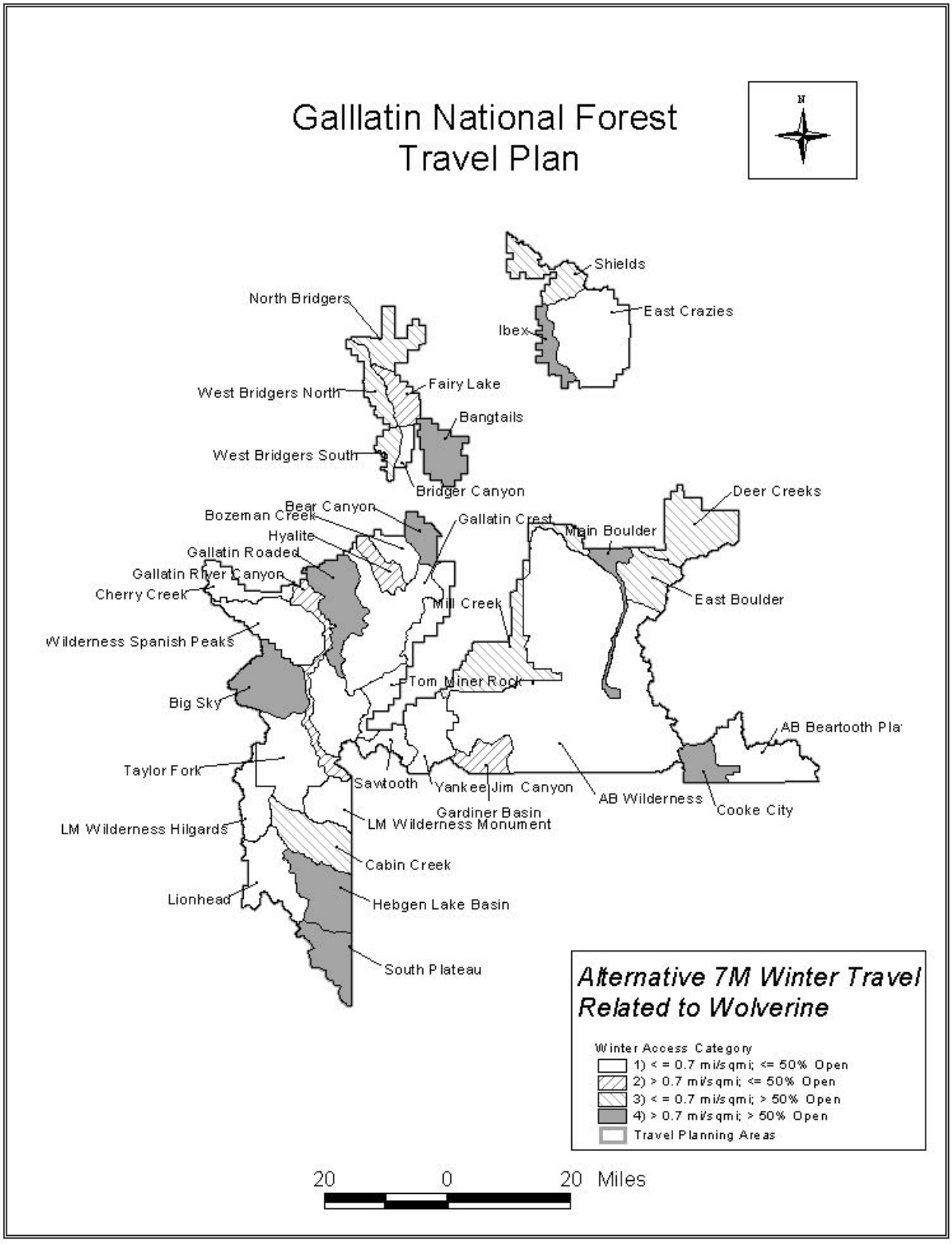


Figure 3.22. 12 Winter access categories, Alternative 7-M.



Cumulative Effects

Net Effects of Past and Present Programs and Activities

Past and present human uses and actions have contributed cumulative effects to wolverines primarily in the form of habitat alterations and associated human development, on both public and private lands. Human-induced habitat modifications, both temporary and permanent, alter the wolverine's natural habitat in ways that can reduce security and thermal cover, affect prey distribution, improve access for other predators and competitors, or pose barriers to movement. Human use in wolverine habitat can cause wolverine mortality through trapping or vehicle collisions. Disturbance from human activities in wolverine habitat can affect wolverine physiology, behavior, and habitat use patterns, which can deplete critical energy reserves, and/or displace wolverines from otherwise suitable habitat. Excessive energy loss can affect the overall fitness of individual wolverines. Long-term or permanent displacement effectively reduces the amount of suitable habitat available for use by wolverines. A detailed analysis of cumulative effects due to activities and programs other than travel management is available in the project file (Dixon 2006b). A summary of the major land use actions considered to impact wolverines is provided here.

Habitat alterations include timber harvest, fire, insect or disease outbreaks, weed infestations and major developments that alter the wolverine's natural habitat and/or pose barriers to movement. Removal of forest cover, either through anthropogenic or natural processes has the effect of reducing security cover available to wolverines, and can affect foraging opportunities by altering plant communities and/or distribution of prey species. Activities that remove forest cover at higher elevations could affect denning habitat suitability by altering structure that may be contributing important denning habitat components; e.g. fallen logs (Banci 1994:110).

Major habitat alterations associated with human development, agriculture, large-scale mining operations and recreation resorts have likely had the greatest cumulative impact to wolverines occupying habitat in the Gallatin National Forest. Extreme habitat alteration and high levels of human disturbance are associated with communities outside the forest boundary (Big Timber, Livingston, Bozeman and West Yellowstone), as well as smaller communities inside the forest boundary (Big Sky, Gardiner, Cooke City, Silvergate, Jardine and the Royal Teton Ranch). Major mining activities have occurred in areas around Cooke City, Jardine, and the Stillwater mining complex. Developed ski areas by nature of the activity are generally located in high quality winter wolverine habitat. Clearing trees for runs, lifts, and other facilities has resulted in a permanent habitat loss for wolverines, while disturbance associated with ski area use has reduced the amount of suitable winter habitat, including denning habitat. Developed ski areas that affect wolverine habitat within or near the Gallatin Forest boundary include Bridger Bowl, Big Sky, Moonlight Basin and Pioneer Mountain.

Projected Combined Effects of Reasonably Foreseeable Programs and Activities

Projected effects of reasonably foreseeable programs and activities have potential for both positive and negative cumulative effects to wolverines and their habitat. Generally speaking, traditional land management practices are trending toward more ecologically sensitive programs. Unmanaged recreation, invasive species, unnatural fuel buildup and loss of open space are four major ecological

threats recognized by public land management entities. Accordingly, management practices are being redesigned to reduce ecological impacts while still allowing for the maximum spectrum of land uses within the capability of resources. On the other hand, private development is occurring at an exponential rate. Major developments (cities, high-volume/speed transportation systems) can influence movement capability and thus affect wolverine dispersal patterns and distribution. Reasonably foreseeable actions that could have a major impact on wolverines and their habitat within the Gallatin Forest over the life of the Travel Plan include the approved expansion and associated development at Bridger Bowl Ski Area (involves clearing of runs, etc. on NFS land plus commercial and housing development on private land), plus other major commercial and housing development on private land.

The Gallatin Land Consolidation Act of 1998 involved a massive exchange of checkerboard lands between the USFS and Big Sky Lumber Company. This exchanged served to consolidate large blocks of land into private ownership in the Battle Ridge area, the west side of the Bangtail Mountains and in the Big Sky area. These lands are now much more accessible for housing development, some of which has already begun. It is reasonably foreseeable that these areas will continue to be developed over the life of the Travel Plan. The Big Sky area contains high quality wolverine winter habitat and is important in terms of providing continuity of habitat in the Madison Mountain Range. The Bangtails and Battle Ridge areas have lower quality habitat for wolverines, but are important for maintaining habitat connectivity between the southern portion of the Gallatin Forest and key wolverine habitat in northwest Montana.

Cumulative Effects of Past, Present and Reasonably Foreseeable Programs and Activities with the Travel Plan Alternatives

Alternative 1
Alternative 1 would maintain the overall highest travel route densities, as well as the option for off-route travel by OHVs. It would also retain higher proportions of NFS land open to dispersed snowmobile use than all other alternatives (except Alternative 2, which has essentially the same winter use configuration). This scenario would allow for greater dispersal of large numbers of people across the entire forest, direct and indirect effects of this alternative, combined with similar impacts from unrelated programs and activities would have greater overall cumulative effects on wolverines and their habitat than Alternatives 2 through 7-M.

Alternatives 2 through 7-M
Cumulative effects under Alternatives 2 through 7-M would differ slightly relative to the variations in direct and indirect effects within the range of alternatives. However the basic change in summer travel management philosophy from all routes and areas open for motorized use unless designated closed, to a system where all summer motorized traffic is restricted to designated routes, would result in a notable reduction of direct and indirect effects associated with travel management, and a corresponding reduction in contribution to overall cumulative effects. Alternative 2 is essentially the same as Alternative 1 for winter uses, but Alternatives 2 through 7-M decrease the proportion of winter wolverine habitat open to dispersed snowmobile use.

Effects of Proposed Goals, Objectives, Standards and Guidelines

Alternative 1 (Existing Condition)

Under Alternative 1 (existing condition), the goals, objectives, standards and guidelines related to travel management would remain as they are currently stated in the existing Forest Plan. Much of the programmatic direction contained within the existing Forest Plan is outdated and less useful than perceived when the existing Forest Plan was completed in 1987.

Alternatives 2-6

Under Alternatives 2-6, proposed goals, objectives, standards and guidelines, are based on more current science, and tier to current direction that is separate from the Forest Plan. Proposed programmatic direction, if implemented, would generally serve to improve wolverine habitat quality by reducing human disturbance factors in important habitats and during critical periods. GOAL A basically states that the overarching focus of the Forest Travel Plan is to provide a system that promotes public enjoyment of the Forest's resources, including wildlife. People will generally only support conserving a resource that they perceive provides some value to them. If the public were not allowed broad access to the natural resources available on NFS lands, there would be little incentive to support management programs focused on conservation of those resources.

OBJ A-6 provides designations for backcountry airstrips located throughout the Forest. This objective applies only to Alternative 3. Potential backcountry airstrip sites are identified in Table I-3. Allowing aircraft landing in the backcountry could add considerable disturbance in wolverine habitat. The presence of backcountry airstrips (including all potential locations listed in Table I-3) could lead to an increase in recreational aircraft use, including low-level sight seeing flights over and around high elevation habitats important to wolverines. The South Plateau airstrip site is located above 8,000 feet and is in close proximity to high quality summer/fall wolverine habitat.

Restricting wheeled motorized travel to designated routes (STANDARD A-6) would significantly reduce the potential for motorized disturbance in wolverine habitat, reduce habitat alteration resulting from the development of user-created routes, lower human disturbance influence on distribution patterns of wolverine prey species, help to control the spread of noxious weeds and help to control the proliferation of human pollution (garbage) on the landscape.

GOAL B recognizes the Forest's desire to provide public access to all Gallatin National Forest Land. Improving or increasing public access to NFS lands that currently have poor or no public access could have negative impacts to wolverines by increasing human presence and associated disturbance factors in areas that currently serve as important wolverine security habitat.

GOAL C ties travel management programmatic direction with overall Forest Plan goals for natural resource management and protection (including wildlife). This goal statement provides the basis for restricting public travel when and where necessary in order to effectively manage within constraints of resource capabilities. This mindset would benefit wolverines and other wildlife by allowing for restrictions on public uses in favor of meeting habitat needs for wildlife. This goal statement also contains objectives (OBJ. C-1 and C-2) that provide for road and trail rehabilitation

to physically close and revegetate existing non-system road and trail facilities. Since non-system roads and trails are not always effectively closed, some motorized use occurs on these facilities, allowing motorized disturbance to persist. Effectively closing and rehabilitating these features would benefit wolverines by reducing motorized disturbance levels and restoring native vegetation.

Providing for habitat connectivity in order to promote wildlife movement and genetic interaction (GOAL E) would benefit wolverine populations by acknowledging the importance of dispersal routes used by animals. Wolverines are naturally wide-ranging creatures and dispersal is an important mechanism for maintaining genetic interaction among and between subpopulations. Fragmentation of wolverine populations can result in lowered genetic fitness and increased vulnerability to local extirpations.

The wolverine is currently listed as a sensitive species on the Gallatin Forest. Managing human use of the Forest road and trail system to maintain sensitive species and their habitat (GOAL F) is intended to benefit all sensitive species. Wolverines are similar to grizzly bears and lynx in their habitat use patterns and sensitivity to human disturbance. Therefore, OBJECTIVES F-1 and F-2, and STANDARDS F-1 and F-2 would benefit wolverines by limiting motorized access route densities, minimizing human food sources and limiting snow compaction.

Wolverines are habitat generalists and are opportunistic in their foraging patterns. As such, vegetative diversity provides a wide range of habitat options for wolverines. Maintaining healthy vegetative conditions in key habitats such as willow, riparian, whitebark pine and old growth (GOALG, OBJ G-1) would provide for continued habitat diversity important to sustaining healthy wolverine populations.

Providing high quality security habitat in areas important to wildlife reproduction (GOAL H, OBJ H-1) would benefit wolverines by helping to protect wolverine reproductive habitat (female denning areas) from human intrusions, and would also serve to promote healthy wolverine prey populations by protecting big game calving and fawning areas.

Providing for habitat security on important ungulate winter range (GOAL I, OBJ I-1) would benefit wolverines by reducing the potential for human disturbance during an energy-critical time and thereby promoting healthy prey populations.

Effective closure of project roads (STANDARD L-1) would benefit wolverines by reducing overall motorized access route densities and decreasing or eliminating associated motorized disturbance.

STANDARD M-7 would essentially prohibit creation of parallel routes on opposite sides of stream courses within the riparian zone. Riparian vegetation provides important habitat for a variety of wildlife, including potential wolverine prey species. Also, stream courses are often used by wildlife (possibly including wolverines) as travel routes. Therefore, protecting stream courses and associated riparian habitat would benefit wolverines. STANDARD M-8 would effectively set a ceiling on public motorized access route density, which would also benefit wolverines. GUIDELINES M-9 and M-10 would influence the location, availability for public access and eventual disposition of temporary project roads and other facilities created for administrative

purposes. These guidelines would effectively limit use and associated disturbance levels, which would be beneficial for wolverines.

Preserving the natural integrity of designated Wilderness Areas (GOAL N and associated standards and guidelines) would benefit wolverines by preserving the characteristics of remote, rugged, and relatively inaccessible areas that appear to be disproportionately selected by wolverines across the landscape.

Alternative 7-M

Under Alternative 7-M, programmatic direction was organized slightly different than for Alternatives 2-6. In some cases, goals, objectives, standards and guidelines actually changed for Alternative 7-M, whereas in other cases, only the identification system changed (e.g. alpha-numeric identifiers for goals, objectives, etc.) In the latter cases, the effects analysis for Alternatives 2-6 applies for Alternative 7-M as well.

GOAL A: Same as Alt. 2-6.

OBJ. A-6 is essentially the same as in Alt. 2-6, with the exception that there are no potential site-specific locations for backcountry airstrips identified, and instead there are geographic areas listed in which backcountry airstrips for public recreational use would be prohibited. Effects to wolverines from the possible future creation of backcountry airstrips would be the same as discussed for Alt. 2-6. In addition, Alternative 7-M contains a standard (A-7) that expressly disallows landing and/or takeoff of recreational aircraft, except at designated and authorized sites, of which there currently are none on the Gallatin Forest. Any future proposals for backcountry airstrips would have to go through a separate NEPA analysis.

STANDARD A-8 is the same as STANDARD A-6 for Alt. 2-6.

GOAL B: Same as Alt. 2-6.

GOAL D, OBJ. D-1 and D-2 are the same as GOAL C, OBJ. C-1 and C-2 for Alt. 2-6.

STANDARDS D-5 and D-6 are essentially the same as STANDARDS L-1 and M-8 for Alt. 2-6.

GUIDELINE D-7 addresses new roads constructed for project activity. This guideline in Alt. 7-M would have similar effects as those described above for GUIDELINES M-9 and M-10 in Alt. 2-6.

GOAL F and OBJ. F-1 contain essentially the same direction as GOAL E in Alt. 2-6.

GOAL G is similar to GOAL F in Alt. 2-6, but the wording is changed slightly. Whereas the statement for Alt. 2-6 specifies "**Threatened, Endangered and *Sensitive* Wildlife Species**" the statement in Alt. 7-M changes "***Sensitive***" to "***Species of Special Management Designation***". This change was made to reflect proposed terminology changes in the Federal Planning Regulations, where the term "sensitive species" is replaced with "species of concern" and "species of interest". The term "species of special management designation" was used to reflect this possible change, as

well as to include other categories such as "management indicator species". Effects to wolverines would be essentially the same as described above for GOAL F in Alt. 2-6. Standards specific to grizzly bear and lynx (F-1 and F-2 in Alt. 2-6) were dropped from the programmatic direction in Alt. 7-M. However, it should be noted that direction reflected in STANDARDS F-1 and F-2 (Alt. 2-6) is currently contained in separate direction documents for grizzly bear and lynx. GUIDELINE G-2 is added in Alt. 7-M to protect important habitat components known to be occupied by species of special management designation, which would include wolverines.

GOAL H along with OBJ. H-1 and GUIDELINES H-2 and H-3, are similar to GOAL G and OBJ. G-1 in Alt. 2-6. However, the direction in Alt. 7-M is a bit more detailed and would likely provide better protection for key habitats than the language contained in Alt. 2-6.

GOAL I plus GUIDELINES I-1 and I-2 are essentially the same as GOALS H and I, plus OBJS. H-1 and I-1 in Alt. 2-6, but worded slightly differently, and replace objectives with guidelines. Effects to wolverine would be similar to that described above for Alt. 2-6, but the wording in Alt. 7-M is more accurate and should be better for effectively managing travel facilities and use to the benefit of wolverines.

GOAL J is the same as GOAL N in Alt. 2-6.

Consistency with Laws, Regulations, Policy, and Federal, Regional, State and Local Land Use Plans (including the Forest Plan)

The National Forest Management Act (36 CFR 219.19) directs federal agencies to manage habitat to provide for viable populations of all native and desired non-native fish and wildlife species. The wolverine is native to this area, and is classified as a Forest Service sensitive species. Sensitive species are those for which population viability is of concern. Direction for management of sensitive species is contained in the Forest Service Manual (FSM 2672.1), which states that these species must receive special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for Federal listing. The proposed Gallatin Forest Travel Plan analysis considered potential for alternative scenarios to have adverse impacts on wolverines. Alternatives 4 through 7-M each incorporate specific measures designed to reduce known impacts on wolverine habitat. Alternatives 2 through 7-M all include additional forest-wide goals, objectives, standards and guidelines that would improve habitat conditions over time and promote healthy populations of sensitive species.