ISSUE 3: BIOLOGICAL DIVERSITY AND ECOLOGICAL SUSTAINABILITY

Changes from the Draft to the Final EIS

The changes in this issue are fairly minor, consisting of a few editorial changes. There were no changes in the three corridor analyses from Alternative 7 to 7-M. The cumulative effects section has been enlarged and is more thorough (see Cherry, 2006, Cumulative Effects Worksheet in the Project Record for this issue). The General Wildlife Issue is referred to for a discussion of 'core' habitat and how that relates to wildlife corridors. The section on the effects of goals, objectives, standards, and guidelines has been reworked with the updated information. Some additional literature has been cited.

Introduction

Biological diversity, or biodiversity, has been defined in a variety of ways. A synonym might be species diversity, referring to the many species of plants, animals, fungi and microorganisms that exist on the earth. E. O. Wilson defines biodiversity as *"... the variety of life across all levels of organization from genetic diversity within populations, to species, which have to be regarded as the pivotal unit of classification, to ecosystems"* (Takacs 1996:50). Because of this broad definition, it is necessary to break out the components of biodiversity that can be affected by transportation systems. The facets of the biodiversity issue include vegetative diversity, viability and the intertwined issue of connectivity/corridors/linkage, which, for simplicity, will be referred to as corridors.

Transportation systems of any kind across the landscape with linear trails and/or roads may affect vegetation, wildlife movement and habitat use; facilitate species invasion (native and nonnative plants and animals) and disrupt corridors. Native wildlife species create trails on which they move across the landscape in repeated patterns, so trails are not new to the natural environment. Roads and motorized trails are usually wider and may have different surfaces than non-motorized trails. Native vegetation is usually removed from the road or trail, and sometimes to a certain width on either side of the road or trail depending on the type of road, speed allowed, terrain, and other factors. In addition, motorized trails receive motorized traffic in varying amounts that may affect the environment by disturbing or displacing animals. Displacement is addressed in a number of issues including General Wildlife, Big Game, Grizzly Bear, and Wolverine.

The Travel Management Plan or any other Forest Service document or action must maintain viable populations of wildlife species (NFMA 1976). The question is: in what ways can travel management influence the viability of wildlife species? The direct effect of roads and trails may isolate populations of some species into metapopulations and affect species viability. However, this is much more likely to occur with major highways not under the jurisdiction of the Forest Service. The most likely threat to viability that the Forest Service transportation system could cause is damage to wildlife movement corridors in areas not currently covered by recovery plans and specific direction for threatened and endangered and other species.

In addition, biodiversity could be affected by the effect of transportation routes on potential old growth or other rare habitats, such as willow, aspen, cottonwood, and whitebark pine.

Affected Environment

This section discusses components of the Biodiversity issue: corridors, vegetative diversity and viability.

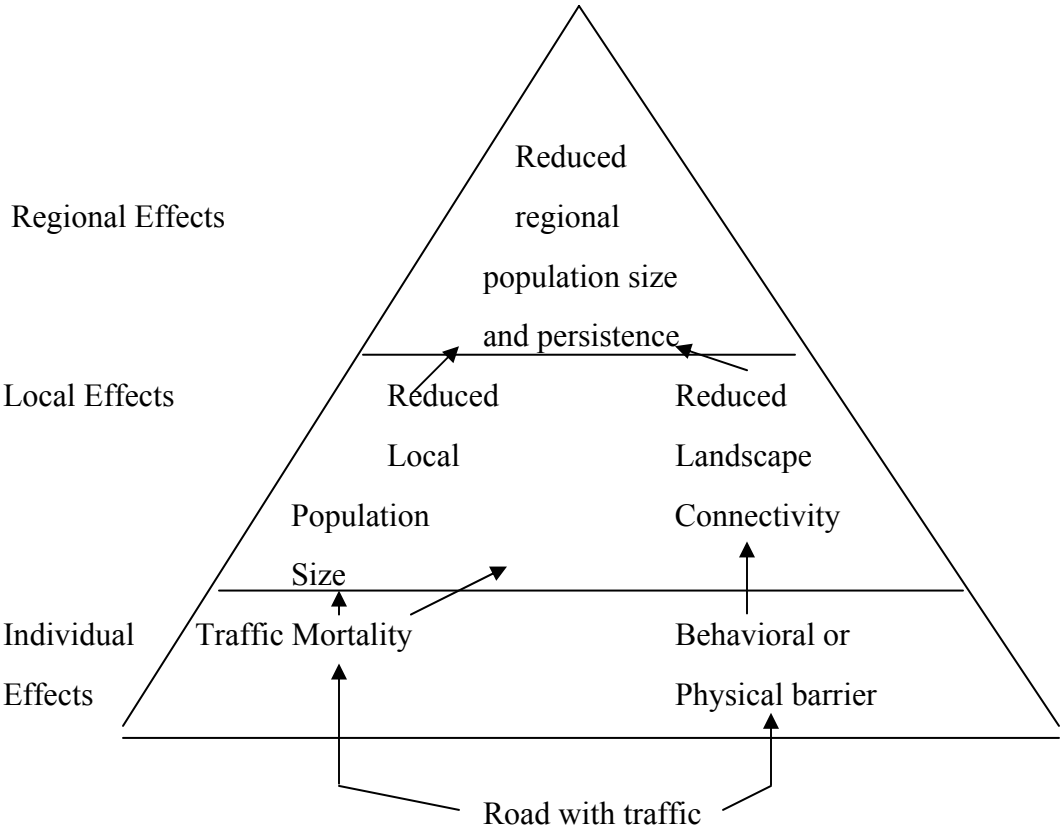
Corridors

Corridors are defined as: *"...avenues along which wide-ranging animals can travel, plants can propagate, genetic interchange can occur, populations can move in response to environmental changes and natural disasters, and threatened species can be replenished from other areas"* (9th Circuit, FOG:45). The term corridor is often used synonymously with connectivity and linkage or linkage zone. Corridors help determine how and if an animal can move through the landscape. Confusion arises with whether or not the species in question just uses a corridor for travel or if it must be able to meet all of its needs for survival and reproduction there. The intention in this document is to define a corridor as a passageway, and not as meeting the full habitat requirements for the species of interest. A corridor need not provide all of the life requirements for a species within the corridor (passage species), but some species will live entirely within a corridor (corridor dwellers).

Wildlife corridors may have several functions:
1) Wide-ranging animals can move through these corridors.
2) Plants can propagate.
3) Genetic interchange can occur.
4) Populations can move in response to changes in the environment.
5) Areas can be recolonized where populations have been extirpated (Beier and Loe 1992).

Roads affect the connectivity of the landscape. *"Landscape connectivity is the degree to which the landscape facilitates animal movement and other ecological flows."* Good connectivity exists if there are no barriers in the landscape and the habitat types that exist are usable by the species of interest. Many species must move through the landscape to meet their habitat needs throughout their life, and some species must move large distances (e.g., large carnivores, migratory species). Barriers to movement can result in mortality, reduced reproduction, and a smaller, less viable population. Connectivity also allows areas to be repopulated if there have been local declines of some species. Roads can be barriers to animal movements. Forest interior species may be the most affected by roads. This is because roads provide openings in a forested area and the openings change both the abiotic and biotic factors in the habitat (light, snow depth, precipitation, facilitation of movement for some predators, etc.). Species that need to travel large areas may also be seriously affected by roads (Forman 2003:129, 130; Figure 3.3.1).

Figure 3.3.1 Road system effects on individual animals and the wildlife populations (Forman et al. 2003:130).



Roads may pose a threat to carnivore populations due to road mortality (see Issue 9: General Wildlife) and the indirect effects of barriers. Populations of both small and large mammals may become effectively isolated by barriers. Barriers to wildlife movement are most often caused by wide roads that have high speeds and may have center barriers and/or medians. Roads that have adjacent power lines, frontage roads, and/or railroad tracks can be formidable barriers for many wildlife species. Secondary and unpaved roads seem to have little effect on most animal movement and can be fairly permeable to wildlife. However, for small animals, the width of the road can be an important variable. The relative permeability (ease of crossing) of a road and its adjacent edge habitat influences how animals may cross it. The hardness or abruptness of an edge seems to be important to some animals, especially forest dwelling species. Some animals may actually move parallel along a road (Forman 2003:130-133).

Roads may serve as a barrier to some species, but they may also facilitate movement of other species (Forman 2003:130-133). Modifications of soil and vegetation due to the presence of the route may increase both the numbers of animals and alter the species that are able to exist along the road corridor. Roads and trails that are not heavily used by people may provide easy travel routes for some animals and perhaps provide access to more prey (Forman 2003:134).

Where habitat truly occurs in islands, connectivity between islands becomes important. Physically continuous corridors may be preferred by many species. Riparian corridors may be especially

important due to the presence of water, nutrients and energy from the riparian system. Riparian systems are often dominated by hardwoods and host higher bird populations. Riparian strips are excellent means of connecting islands of habitat across elevations. Because conifer types are much more common in North America than hardwoods, the association and value of hardwood riparian areas is pronounced. Lower elevations support more species than higher ones, and moist sites are richer in species diversity than dry sites (Harris 1984:141, 143, 145, 153) (see also Riparian Issue).

Ruediger (1996) noted that rare carnivores appear to be present only in locations with the lowest densities of highways in the United States. Mid and large-size carnivores typically have large home ranges and they range widely in the environment. They may be more vulnerable than most species to habitat fragmentation on a landscape scale (Claar et al. 1999:7.47). Even for common species like elk, it is critical to maintain security areas and migration corridors (Canfield et al. 1999:6.13). Elk are addressed in detail under the Big Game Issue.

In 1996, Ruediger hypothesized that increased highways and roads have had a negative effect on carnivores, and that the loss of some carnivores in parts of the lower 48 states is related to highway densities. As the standard of road increases, so does the traffic associated with the road, and the impact on carnivores (Table 3.3.1). At high to very high paved road densities, carnivores have less likelihood of persistence. Most Forest Service contribution of road impacts to wildlife appears to occur at the lower impact part of Table 3.3.1 (low to moderate impact), because that is what makes up most roads under Forest Service jurisdiction (Ruediger 1996). Most paved, high-speed roads are not on the National Forest or under Forest Service management.

Table 3.3. 1 General relationship between carnivores and roads/highways (modified from Ruediger 1996:6).

Type of Road	Impact on Large Carnivores
No Road	None
Closed Forest Road	Low
Open Forest Road	Moderate
Unpaved Main Road	Moderate/High
Paved Two-lane Road	High
Divided Four-lane Road	Very High
Fenced Divided 4-lane Road	Very High

Ruediger et al. (1999) evaluated "key linkage areas" for large and mid-sized carnivores in the northern Rocky Mountains. Key linkage areas are areas where habitat connectivity has been decreased. The effect of growing transportation systems is pronounced on carnivores that have large home ranges, low density and low fecundity rates.

Road development and expansion often includes:
1) Unpaved roads become paved resulting in higher speeds, more traffic and increased human use.
2) Highways are widened from two to four lanes.
3) Two-lane highways are widened, straightened, and passing lanes are added.

Unfortunately, accompanying major roads are often power lines and their right-of-ways, and sometimes railroads, which increase the width of the area an animal must cross and offers numerous

hazards to safe crossings. Highways and private lands are the elements that lead to the most risk to key linkage areas. Those areas with high priority for maintaining wildlife connectivity are:
1) Four-lane highways.
2) Two-lane highways that may be upgraded.
3) Two-lane highways with high traffic volume.
4) Roads with a high potential for improvement.
5) Highways that parallel railroads.

At 2,000-3,000 vehicles/day, highways have adverse impacts to wildlife by fragmenting habitat and causing mortality (Ruediger et al. 1999). Most roads under Forest Service jurisdiction do not have these characteristics, but busy state and federal highways that cross National Forests often do. The State of Montana is composed of 55% private land, 29% federal and 6% state land (Ruediger et al. 1999). The large amount of private land surrounds the islands of mountainous National Forests. Once the private lands are developed, it will be much more difficult for wildlife to move between protected islands of public land.

For linkages, Interstate highways that are typically four-lane and often have some type of center barrier and large clearings on either side as well as occasionally in the median, are the roads of most concern (Ruediger et al. 1996). On and around the Gallatin National Forest, the road of most concern is Interstate-90 that bisects the Forest south of the Bridgers/Bangtails and Crazy Mountains through Bozeman Pass. Other roads of some concern are two-lane highways with a high potential for being upgraded, roads with high traffic volume, highways paralleling railways, and highways with the potential for improvements that would increase traffic volume. Roads with potential to increase traffic density and speed are of most concern. Road segments on or near the Forest that have been identified include Highway 191 from Big Sky to Highway 287 junction, and Highway 212 from Beartooth Pass to the junction of Highway 89, Highway 20 from the junction with Highway 287 to the Idaho border, and Highway 89 in Yankee Jim Canyon (Ruediger et al. 1999). The actual linkages identified by Ruediger et al. (1999; see Cumulative Effects section) are either not located on the Forest or are not roads the Forest Service has jurisdiction over. Therefore, for the most part, the corridor issue is one of cumulative effects, but the parts of the National Forest that facilitate animals to get to the corridors of concern are part of direct or indirect effects analysis and several of these areas will be analyzed.

Vegetative Diversity

How roads affect vegetation is a biodiversity issue. Direct habitat loss is addressed in the General Wildlife Issue and is quite small in acreage. However, the effect of roads on various habitats, especially rare habitats, is an important consideration. In order to address this issue, the analysis needs to look at the proportion of rare habitats being affected by roads. These rare and/or important habitats include potential old growth stands, riparian areas, and especially cottonwood and willow communities, aspen, and whitebark pine.

Viability

Viability is typically analyzed by examining the habitat available to a species and activities that may affect that habitat unless a species has a recovery plan with recovery criteria that can be addressed. Many of the rarer species are addressed in detail under their own issue analysis such as for lynx,

wolverine, grizzly bear, and sensitive species. The potential threat to viability that can be caused by the Forest transportation system that is not already managed through various recovery plans and standards and guidelines for threatened, endangered and sensitive species is damage to wildlife movement corridors. Further viability information is available in the project record (Cherry and Tyers 2003, Samson 2006.)

With very small wildlife populations, human or predator access that is facilitated by roads and trails may lead to direct or indirect mortality of individual animals. It is unlikely that this would have such a major effect as to affect a species' viability (see Issue 9: General Wildlife). In some cases, activity occurring on roads and trails is known to displace species from the area near the road, leading to loss of effective habitat (see Issue 9: General Wildlife). In extreme cases, this type of response to roads could threaten small populations of some species.

Direct and Indirect Effects

Analysis Methodology

Most of the analysis for this issue was conducted through literature searches on biodiversity and through GIS queries for potential old growth and rare habitats (see Project Record, Cherry 2006 Potential Old Growth and Rare Habitats queries) where they are intersected by roads. These queries were made only for Alternative 1, because this is the existing pattern of routes on the landscape, and little change will occur in vegetation succession during the planning period. In other words, any effects to potential old growth and rare habitats already exist, and any new roads proposed will go through site-specific NEPA analysis.

A GIS analysis was done of potential old growth on the Gallatin National Forest and how it is affected by roads and trails (motorized and non-motorized) under Alternative 1. Each road was buffered by 100 m as the average width affected (effective habitat lost) by roads. This buffer was given because the presence of a road influences a potential old growth stand by more than just road width due to changes in light, precipitation, removal of forest interior habitat for a distance from the edge, etc. This reflects both the direct influence of the road and the indirect influence of the road. Harris (1984:110-112) recommends 3 tree heights as the influence of an opening into a potential old growth stand. This was estimated to be 100 m, and could be an overestimate since the average tree height on the Forest is probably less than 100 ft. It was not believed that trails had the same type of influence into potential old growth stands since trails are also a natural feature on the landscape and are narrower than roads.

An analysis of rare habitats such as willow, aspen, cottonwood and whitebark pine was conducted to determine what effect travel routes (motorized and non-motorized) have had on these habitats. For this analysis, the Forest vegetation database was queried for these habitats. Roads and trails were given a universal 20-foot width of direct habitat loss. Indirect habitat loss would be greater. Refer to the Riparian Issue for a more thorough discussion of this habitat.

For the corridor issue, most of the effects to wildlife occur off-Forest and are primarily cumulative effects, because the Forest does not have jurisdiction over the highways (such as I-90) where corridors are an issue. However, for two locations on the Forest, Bozeman Pass (Bear Canyon TPA) and the North Bridgers (North Bridgers TPA), small areas of National Forest were analyzed

for motorized and non-motorized route densities to help ascertain the potential for wildlife to travel through these areas to the corridors of concern without many disturbances or barriers. The Lionhead TPA was also reviewed for route density and its use as a corridor from east to west and vice-versa. In addition, the core habitat analysis conducted for the General Wildlife Issue (see Core map in project record), can show the parts of the Forest influenced to a greater or lesser degree by motorized routes and a combination of motorized and non-motorized routes. The percentage of core by TPA can give some indication of how or if wildlife will move through the TPA (see tables of core habitat percentage by TPA in the General Wildlife Issue).

Corridors

Generally, the lower the motorized route density, the more likely it is that animals will be able to move through the landscape. There is not much literature on the effects of non-motorized routes on wildlife movement, and there is very little literature that addresses the differences in the effects of motorized trails as opposed to roads on wildlife. In addition, there is not a true threshold route density at which the landscape becomes impermeable to wildlife movement. A number seen most often in the literature and plans as a recommendation for some species such as elk and bears is a road density of less than 1 mi per sq mi at which it is believed elk can use approximately 60% of the habitat and move through the landscape with relative ease (MFWP 1992:136). However, even at road densities of 3 mi/sq mi, elk can utilize over 30% of the habitat (Lyon et al. 1985).

Often, in the scientific literature, the motorized routes referred to are roads and do not include motorized trails (Lyon et al. 1985). If there is a mile of interstate highway or other major route, it may make wildlife movement difficult, if not impossible. If a mile of motorized route happens to be a seasonal motorcycle trail, this may not have much influence on wildlife. The effects of motorized trails on wildlife have not been studied in detail in this area. Most studies in other areas either do not consider motorized trails to have the same effect on wildlife as roads or trails were ignored in the study (Forman 2003:131, 134, Lyon et al. 1985). In reality, the effects of motorized routes on wildlife, whether the routes are roads or trails, probably depends on the amounts (Leege 1984, Edge et al. 1987) and types of use, timing of use, and whether or not cover is available adjacent to or near the route (Lyon et al. 1985, Yonge 2001:56-58).

Some studies have developed classifications of use levels on roads and thus the effect to wildlife (Lyon and Christiansen, 1992, Perry and Overly 1977). For this analysis, it was assumed that roads have higher levels of traffic for longer periods during the day and throughout the year, while motorized trails tend to have lighter use, usually for a shorter time period during the day, and may have higher use at one season of the year (e.g., during hunting season) (Christensen et al. 1993).

Roads will typically have a wider cleared area than trails. The amount of cover near the route varies with the type of vegetation and the topography, but may not be much different between roads and trails on the average. Although non-motorized routes are mentioned, they are not believed to have much effect on wildlife movement and are not counted in the access model for grizzly bear secure habitat (ICST 2003).

This analysis looked at three locations on the Forest. Two of the pieces of National Forest analyzed separately for this issue are the north end of Bear Canyon TPA (leading to linkage across I-90) and

the north end of the Bridgers (North Bridgers TPA) (leading to the Big Belts). Road density for the Lionhead TPA was also reviewed as a linkage to Raynold's Pass and the Centennial Range.

Bear Canyon Corridor

This 8 square mile analysis area for Bear Canyon consists of 5.12 sq mi of National Forest and 2.92 mi of non National Forest (R7E, T3S, sections, 4, 5, 6 and R7E, T2S, sections 29, 30, 31, 32, 33). Under all alternatives, this area contains 1.2 mi of interstate highway (I-90) and 5.1 miles of non Forest Service roads. This gives a road density of 0.78 mi/sq mi of non-Forest Service routes for all alternatives and is additive to the Forest Service routes under each alternative (Table 3.3. 2). The Interstate highway (I-90) is the major impediment to wildlife movement in this corridor. None of the roads contributing to road density fall under the jurisdiction of the Forest Service. It should be noted that although this 8 sq mi of analysis area has the same fairly low road density under all alternatives, National Forest and private land east of this 8 sq mi area has many motorized routes (although some routes are gated and closed to public use).

Table 3.3. 2 Route density for the Bear Canyon TPA corridor. (FS = Forest Service, Non-FS = private, state, other)

Bear Canyon TPA Corridor									
			Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7-M
FS land	Acres	3,278							
	Mi sq	5.12							
Non-FS land	Acres	1,869							
	Mi sq	2.92							
Total land	Acres	5,147							
	Mi sq	8.04							
Interstate Hwy	Miles	1.2							
Roads on non-FS land	Miles	5.1							
Non-FS roads	Miles	7.3							
	Mi/sq mi	0.78							
FS open motorized roads	Miles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FS open motorized trails	Miles		3.5	3.7	3.7	3.7	0.5	0.5	3.2
	Mi/sq mi		0.43	0.46	0.46	0.46	0.06	0.06	0.40
All motorized routes	Mi/sq mi		1.22	1.24	1.24	1.24	0.84	0.84	1.18
Non-motorized trails	Miles		3.7	2.0	4.5	0.0	3.7	3.7	5.0
	Mi/sq mi		0.46	0.25	.56	0.0	0.46	0.46	0.62

Under all alternatives, the Bear Loop Trail #400, sections 1, 2 and 3 are closed to passenger cars and high clearance vehicles. When motorized routes are restricted until July 15, spring wildlife movement may be enhanced. When motorized routes are restricted beginning September 15, fall wildlife movement may be improved.

Alternative 1

There are 3.5 mi of motorized trails on the Forest under this alternative. This yields a density of 0.43 mi/sq mi of motorized trails. There are also 3.7 mi of non-motorized trails (0.46 mi/sq mi). Under this Alternative, all segments of the Bear Loop Trail #440 allow ATVs and motorcycles with no seasonal restrictions. This is the same for the Chestnut Mountain Trail #458.

Alternatives 2 and 3
For these alternatives, there are 3.7 mi of motorized trails on the Forest, having a 0.46 mi/sq mi density. The amount of non-motorized trails varies between the two alternatives from 2.0-4.5 miles for Alternative 2 and 3, respectively. Under these alternatives, the Bear Loop Trail #400 segments 1, 2 and 3 emphasize ATV and motorcycle use, but this use is closed from December 2 to July 15. This is the same for the Chestnut Mountain Trail #458.

Alternative 4
For this alternative, there are 3.7 mi of motorized trails on the Forest (0.46 mi/sq mi density). There are no non-motorized trails in this alternative. Segment 1 of Trail #440 is closed to ATVs and motorcycles, but segments 2 and 3 are open, with a seasonal restriction from December 2 to July 15. Trail #458 is open to ATVs and motorcycles with a seasonal restriction of September 15 to July 15.

Alternatives 5 and 6
For these two alternatives, only 0.5 mi of Forest Service motorized trail is proposed (0.06 mi/sq mi density). For each of these of alternatives, there is 0.46 mi of non-motorized routes. For these alternatives, Trail #440, segments 1 and 2 are closed yearlong to ATVs and motorcycles. Segment 3 is open but restricted from December 2 to July 15. Chestnut Mountain #458 is open to ATVs and motorcycles with a restriction from September 15 to July 15. These alternatives may best facilitate wildlife movement because they have the lowest motorized route density, but it is believed that the interstate highway is the major impediment to wildlife movement. The earlier route closure for Trail #458 (September 15) may offer some benefit for fall wildlife movement in the area.

Alternative 7-M
For this Alternative, there are 3.2 mi of Forest Service motorized trails (0.40 mi/sq mi density). There are 5 mi of non-motorized routes (0.62 mi/sq mi density). All segments of Trail #440 are open to ATVs and motorcycles with a restriction from December 2 to July 15. The Chestnut Mountain Trail #458 is closed to ATVs and motorcycles. The restriction of motorized use until July 15 will offer some benefit for spring wildlife movement in the area. It is believed that wildlife can generally move through this area, and that the major impediment to movement is the interstate highway.

Summary
The only routes that the Forest Service has jurisdiction over are the motorized trails that vary from 0.06 mi/sq mi under Alternatives 5 and 6 to 0.46 mi/sq mi under Alternatives 2, 3, and 4. Total motorized route density varies from .84 mi/sq mi under Alternatives 5 and 6 to 1.24 mi/sq mi under Alternatives 2, 3, and 4. Alternatives 1 and 7-M lie between these for motorized trails and total motorized route densities. It is recommended that motorized routes be relocated away from the ridgeline in this 8 sq mi area (Trails #440 and #458, depending on the alternatives). Animals often use ridges and saddle for travel (Lyon et al. 1985, LCAS 2000). The restriction of motorized use in the spring or fall under some alternatives will benefit spring and fall wildlife movement in the area. It is believed that wildlife can generally move through this area at these motorized route densities, and that the major impediment to movement is the interstate highway (I-90), adjacent railroad, frontage road, and power corridor.

The Bear Canyon TPA connects to the Gallatin Crest TPA to the south which has been of interest as a travel corridor. The Bear Canyon TPA has a medium percent core habitat and allows for wildlife movement. The TPAs of Gallatin Crest and Porcupine/Buffalo Horn have medium to medium-high percentages of core habitat (see General Wildlife Issue and Core map in the project record) for motorized use only, and, in addition, some of the routes have seasonal restrictions. Wildlife will show little displacement in the Crest and Porcupine/Buffalo Horn TPAs.

North Bridgers Corridor

The northern piece of the North Bridgers TPA was analyzed in a manner similar to the corridor in the Bear Canyon TPA. The northern 10 sq miles (T3N, R6E, sections 9, 10, 15, 16, 21, 22, 27, 28, 33, and 34) of this area was analyzed for travel route density. This 10 sq mi piece is more than half in private ownership. It has 4.1 sq mi of National Forest and 5.8 mi sq of private land for a total of 9.9 sq mi (Table 3.3. 3). It contains 2.4 miles of county road and another 6.0 miles of road on non-National Forest. This gives a baseline motorized route density of 0.85 mi/sq mi.

Table 3.3. 3 Route density for the North Bridgers TPA corridor. (FS = Forest Service, Non-FS = private, state, other)

North Bridgers TPA Corridor									
			Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7-M
FS land	Acres	2,613							
	Mi sq	4.8							
Non-FS land	Acres	3,719							
	Mi sq	5.8							
Total land	Acres	6,632							
	Mi sq	9.9							
County road	Miles	2.4							
Non-FS roads	Miles	6.0							
	Mi/sq mi	0.85							
All open motorized roads		0.0							
All open motorized trails	Miles		5.2	0.0	0.0	0.0	0.0	0.0	0.0
	Mi/sq mi		0.53	0.0	0.0	0.0	0.0	0.0	0.0
All motorized routes	Mi/sq mi		1.4	0.85	0.85	0.85	0.85	0.85	0.85
All Non-motorized trails	Miles	5.2							
	Mi/sq mi	0.53							

Alternative 1
The Forest Service has jurisdiction over 5.2 miles of open motorized trails under Alternative 1. This yields an open motorized trail density for the corridor area of 0.53 mi/sq mi. There are no Forest Service routes open to passenger cars or high clearance vehicles. There are also 5.2 mi of non-motorized trails under this alternative giving a non-motorized trail density of 0.53 mi/sq mi.

Alternatives 2 through 7-M
There are no Forest Service motorized roads or trails under these alternatives. Therefore, under Alternative 7-M motorized route density in this corridor is the minimum that can be achieved at

0.85 mi/sq mi. Traffic volume is light in this area, which should increase the probability that wildlife will move through the area. When looking at the potential for wildlife movement south to north or vice versa throughout the entire Bridger Mountain range, Alternatives 5 and 6 do the best job of providing a relatively non-motorized movement corridor along the west side of the mountain range. Motorized Forest Service routes on the east side of the Bridger Mountains make wildlife movement on this side of the range more difficult. It should be noted that effects on private land motorized routes on the east side of the mountain range may make wildlife movement north to south and vice verse on this side of the range more difficult than movement on the west side of the mountain range. Under Alternative 7-M, Middle Fork Flathead Road #642 is closed yearlong to motorized vehicles. Haw Gulch Road #6989 seg, 2 closes September 15. South Fork Flathead Ck. Road #6981 closes December 2.

Summary
Alternatives 2 through 7-M have the minimum motorized route density that can occur in this area due to the presence of non-Forest Service routes and private land. When looking at the potential for wildlife movement south to north or vice versa throughout the entire Bridger Mountain range, Alternatives 5 and 6 do the best job of providing a relatively non-motorized movement corridor along the west side of the mountain range. Motorized Forest Service routes on the east side of the Bridger Mountains may make wildlife movement on this side of the range more difficult. Under Alternative 7-M, Road #642 becomes an administrative road past Cow Creek. This offers some improvement for the wildlife corridor by decreasing motorized use in this location.

The Bridger/Bangtails have some TPAs with very low percent core (see General Wildlife Issue and Core maps in the project record). Fairy Lake and Bangtails have the lowest core for motorized use. However, the west side of the Bridgers is relatively non-motorized and should allow for wildlife use. Wildlife may use the east side of the Bridgers and Bangtails differently, and avoid times of high human use.

Lionhead TPA Corridor

If one looks at the entire Lionhead TPA, the motorized road density appears relatively low (Table 3.3. 4). All motorized routes, including motorized trails, also have a density that is relatively low with only one alternative exceeding one mi/sq mi density. However, it should be noted that almost all of the motorized routes are in the southeastern part of the TPA (see also the Grizzly Bear Issue, Henry's Lake #2, Madison #2 and Mile/Sheep Creek areas which overlap Lionhead TPA). The western 1/3 of the Lionhead TPA is comprised of the Mile/Sheep Creek area. The middle 1/3 of the Lionhead TPA is comprised of part of the Henry's Lake #2 Bear Subunit, and the eastern 1/3 of the TPA is comprised of the western portion of the Madison #22 Bear Subunit (see TPA/Grizzly Bear Subunit map located in the Grizzly Bear Issue). In terms of linear mileage, the mileage of project and administrative roads that are not open to the public range from 37-49 miles among the alternatives. This is high percentage (from about ½ to ¾) of the 45-107 total miles.

Table 3.3. 4 Route density for the Lionhead TPA. (FS = Forest Service, Non-FS = private, state, other)

Lionhead TPA									
			Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7-M
FS land	Acres	56.692							
	Mi sq	88.6							
Non-FS land	Acres	283							
	Mi sq	0.4							
Total land	Acres	56.975							
	Mi sq	89.0							
All open motorized routes	Miles		107	78	76	73	53	45	53
Open motorized roads	Miles		74	48	48	48	42	43	41
	Mi/sq mi		0.84	0.54	0.54	0.54	0.47	0.49	0.46
FS open motorized roads									
All motorized trails	Miles		33	30	28	25	11	2	12
	Mi/sq mi		0.37	0.34	0.32	0.28	0.12	0.02	0.14
All motorized routes	Mi/sq mi		1.2	0.9	0.8	0.8	0.6	0.5	0.6
All Non-motorized trails	Miles		17.2	18.1	22.7	23.4	35.6	44.3	35.6
	Mi/sq mi		0.19	0.20	0.26	0.26	0.40	0.50	0.40

Effects common to all alternatives

There are several major routes that are open to all types of summer motorized use either yearlong or with a seasonal restriction from December 2 to June 15 for all seven alternatives. These include Beaver Creek Road #985, Contour Road #1718, West Fork of Denny Creek Road #1735, Lionhead Road #1791, Mile Creek Road #6904 and Sheep Creek Road #6905. Under all alternatives, some routes are closed to all summer motorized traffic. These include Trapper Creek Road #2540, Watkins Trail #215 segment 3, and Coffin Lakes Trail #209 segment 2.

Alternative 1

This alternative has the highest motorized road density at 0.84 mi/sq mi. There is an additional 0.37 mi/sq mi of motorized trails. There are also 0.19 mi/sq mi of non-motorized routes. As mentioned above, quite a few miles of roads are closed to the public.

Alternative 2

This alternative is a decrease in motorized road density at 0.54 mi/sq mi. There are also 0.34 mi/sq mi of motorized trails and .20 mi/sq mi of non-motorized trails. On Coffin Lakes Trail #209 segment 1, seasonal ATV and motorcycle use is allowed (closed April 1 – June 15). Alternative 2 has Ski Hill Trail #114 open to motorcycles and ATVs (closed Dec 2 – June 15). ATV and motorcycle use is allowed seasonally on Watkins Creek Trail #215 segment 1 (closed April 1 – June 15). Watkins Creek segment 2 is only open to motorcycles (closed April 1-June 15). West Fork Watkins Trail #216 is open to motorcycles only (closed April 1-June 15). Lionhead Trail #217 is open to both ATVs and motorcycles (closed April 1- June 15), and Sheep Lake Trail #218 is open to motorcycles yearlong.

Alternatives 3 and 4
Alternatives 3 and 4 also have 0.54 mi/sq mi motorized road density. They have similar amounts of motorized trail density at 0.28 and 0.32 mi/sq mi each. Both alternatives have 0.26 mi/sq mi of non-motorized trails. Alternative 3 has Ski Hill Trail #114 open to motorcycles and ATVs (closed Dec 2 – June 15), Coffin Lakes Trail #209 segment 1 open to motorcycles (closed April 1- June 15), West Fork Watkins Trial #216 open to motorcycles (closed April 1 – June 15), Lionhead Trail #217, open to motorcycles and ATVs (closed April 1 – June 15), and Sheep Lake Trail #218 open to motorcycles (closed April 1 – June 15). Alternative 4 only differs from Alternative 3 in that Coffin Lakes Trail #209 segment 1 and West Fork Watkins Trail #216 are closed to both motorcycles and ATVs.

Alternative 5
This alternative has a motorized road density of 0.47 mi/sq mi. This alternative also has 0.12 mi/sq mi of motorized trails and 0.40 mi/sq mi of non-motorized trails. Alternative 5 is open to ATV and motorcycles (closed Dec. 2 –June 15) and open to motorcycles and ATVs on Lionhead Trail #217 (closed April 1 – June 15). Routes other than the main routes open in all alternatives are closed.

Alternative 6
Alternative 6 has a motorized road density to 0.49 mi/sq mi. It has 0.02 mi of motorized trail/sq mi and 0.50 mi/sq mi of non-motorized trail. The only routes open in this alternative are the main routes that are open in all alternatives.

Alternative 7-M
This alternative has a motorized road density of 0.46 mi/sq mi. It also has 0.14 mi/sq mi of motorized trail and 0.40 mi/sq mi of non-motorized trail. Under Alternative 7-M, Watkins Creek Trail #215 segments 1, 2 and 3, Coffin Lakes Trail #209 segments 1 and 2, and West Fork Watkins Trail #216 are closed to all motorized use. Ski Hill Trail #114 is open to ATV and motorcycles (closed Dec. 2 - June 15). Lionhead Trail #217 is open to motorcycles and ATVs (closed April 1 - June 15). A new route is created called the Upper West Denny/Contour ATV connector for motorcycles and ATVs (closed April 1 – June 15). West Fork Denny Creek Road, #1735, West Fork Denny/Lionhead #1735C, and Lionhead Road, #1791, are closed from December 2 – March 30.

Summary
Motorized road densities range from 0.46 for Alternative 7-M to 0.84 for Alternative 1. Alternatives 2-4 are the same at 0.54 mi/sq mi of roads, and Alternatives 5 and 6 have 0.47 and 0.49 mi/sq mi of roads, respectively. Motorized trail density ranges from 0.02 in Alternative 6 to 0.37 in Alternative 1. Alternatives 2-4 have similar densities at 0.28-0.34, and Alternative 5 drops to 0.12 and Alternative 6 to 0.02 mi/sq mi motorized trail density. The non-motorized route density ranges from 0.19 to 0.50 mi/sq mi, with Alternative 1 having the lowest and Alternative 6 having the highest. Alternative 7-M has a motorized road density of 0.46 mi/sq. The alternatives with the lowest motorized route density also seem to have the highest non-motorized route density. Again, this analysis includes a significant amount of gated administrative and project roads that are not open to the public and are rarely used by Forest employees unless there is an ongoing project. The motorized road and trail densities are at a low enough level to allow wildlife movement, particularly when taking into account the amount of project and administrative roads that are closed to the

public. Alternatives 5 through 7-M offer low motorized route densities (0.5-0.6 mi/sq mi), however, wildlife movement could potentially be facilitated even more by a reduction in motorized route density on the southeastern side of the TPA. The grizzly bear analysis for Henry's Lake #2 and Madison #2 subunits and Mile/Sheep Creek, which overlay part of Lionhead TPA show similar trends with motorized route density by alternative.

The Lionhead TPA has medium to medium-high core (see General Wildlife Issue in this FEIS and Core map in the Project Record) with both motorized and non-motorized uses. The Hebgen Lake Basin TPA has low percent core with both uses. This is an area that has little potential for change given the range among the alternatives.

Vegetative Diversity

How roads affect vegetation is another biodiversity issue. Habitat loss is addressed in the General Wildlife Issue, however, how roads differentially affect various habitats, and rare habitats in particular, is an important consideration. In order to address this issue, we need to look at the habitats existing on the Forest and determine if roads are seriously impacting the rarer habitats. These types include potential old growth stands, riparian areas, and especially cottonwood and willow communities, aspen, and whitebark pine. It should be emphasized that the following figures (Fig.3.3.2-3.3.4) can give us a relative idea of how rarer habitats are affected by the transportation system, but that mapping of rare habitats and routes is not perfect, and buffering the routes is not perfect so that overlapping two imperfect things to get a percent affected gives results that should be viewed rather generally rather than as exact numbers. It is probably best to view these on a mountain range type scale with relative comparisons from one range to another.

The analysis area for this is the intersection of potential old growth (buffered) and other rare habitats and motorized and non-motorized routes on the Forest.

Potential old growth

A GIS analysis was done of potential old growth (late seral, climax, mature or overmature; see glossary, Green et al. 2004) on the Gallatin National Forest and how it is affected by roads for Alternative 1. This was done by querying the TSMRS database (see Cherry 2006 Potential Old Growth queries). Each road was buffered by 100 m as the average width affected (effective habitat lost). Most studies agree that effects to potential old growth extend into the stand for about three tree heights (Harris 1984:110-112). It was not believed that trails have the same effect of roads on potential old growth since they can be natural features of the environment and they are much narrower than roads. Small openings are a normal part of potential old growth stands. The numbers were calculated by TPA, and combined upward into mountain ranges.

Figure 3.3.2 shows the total Forest Service acres available in each mountain range and those that meet the Gallatin National Forest potential old growth query. The Absaroka Beartooth has many more total acres of potential old growth than the other mountain ranges. Although the Gallatin and Bridger/Bangtails each have much less acreage than the Absaroka Beartooth mountain range, they have a greater percentage of potential old growth than the other ranges (Figure 3.3.3).

The mountain ranges are comprised of 26-43% potential old growth with the Crazy Mountains having the least, and the Gallatin Range having the most. The average percentage of National Forest acres in potential old growth per mountain range is 37%.

Roads (with a 100 m buffer) affect 5% of the potential old growth, on average, by mountain range. The range is from 2 to 17% with the Absaroka Beartooth and Madison with 2% and the Henry's Mountains with 17% affected in Alternative 1 (Figure 3.3.4).

The Crazy Mountains and the Henry's Mountains, with the lowest percentages of potential old growth of the mountain ranges on the Forest, have the largest percentage of potential old growth affected by roads.

Figure 3.3. 2 Total Forest Service acres in each mountain range and total acres of potential old growth. [Figures were generated by making GIS queries of the TSMRS database (see Cherry 2006 queries in Project Record), and then dividing the total acres of the mountain range by the acres of potential old growth to get the percentage potential old growth in the mountain range.]

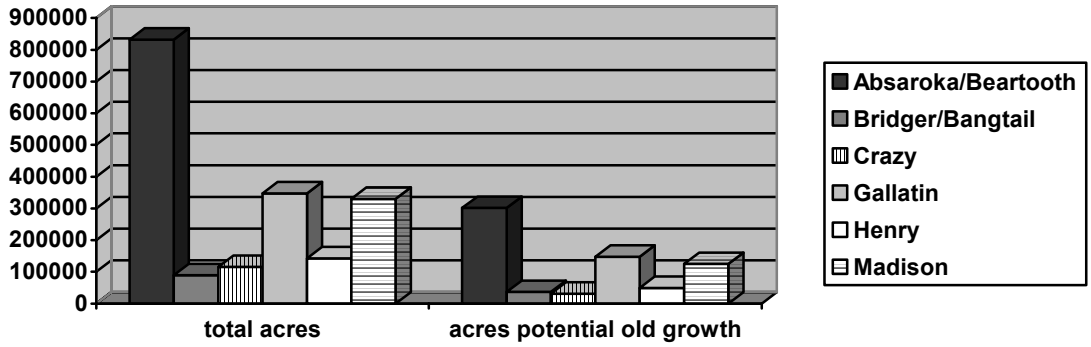


Figure 3.3. 3 Percentage of acres in potential old growth out of total Forest Service acreage by mountain range.

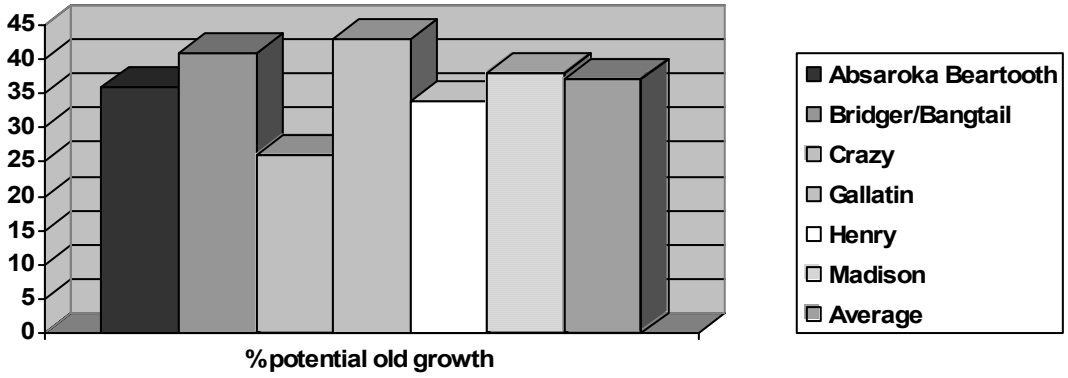
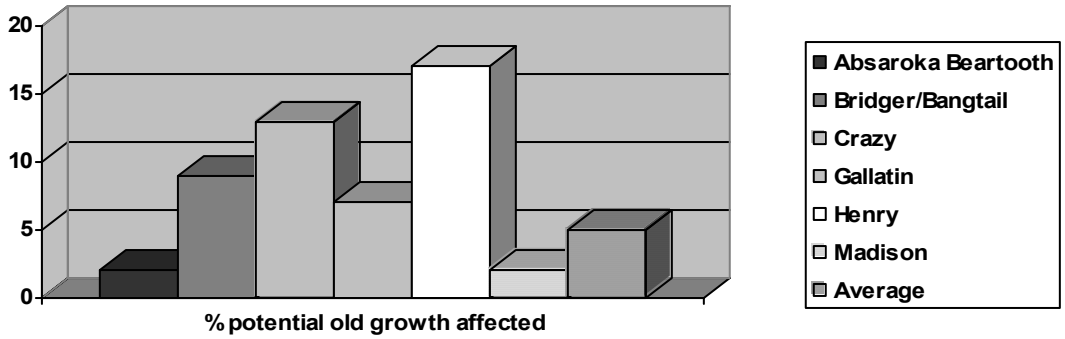


Figure 3.3. 4 Percentage of acres of potential old growth out of total Forest Service acreage, and percentage of potential old growth removed or affected by roads. (This was calculated by overlaying the existing buffered roads with the potential old growth and determining what percent of the potential old growth in each mountain range was affected by the roads.)



The TPAs that have the highest loss of potential old growth due to roads are Hebgen Lake Basin (33%), South Plateau (24%), Bridger Canyon (22%), Hyalite (21%), Gallatin Roaded (20%), Shields (19%), Bangtails (16%), Gardiner Basin, Fairy Lake (14%), and Yellowstone (10%). Two that are adjacent are Hebgen Lake Basin and South Plateau TPAs in the Henry's Mountain Range. Other adjacent TPAs are Bridger Canyon and Bangtails, which are in the Bridger Range. Hyalite, Gallatin Roaded and Yellowstone TPAs are also in close proximity to each other in the Gallatin Range.

The effects of roads on potential old growth are essentially the same across all alternatives because there are few new routes proposed, and the potential old growth through which the current routes exist has already been removed and will not return to potential old growth for many years. Any proposed new routes would go through site-specific NEPA before project initiation, at which time impacts to potential old growth can be mitigated for.

Rare Habitats

An analysis of rare habitats such as willow, aspen, cottonwood and whitebark pine was conducted to see what effect travel routes (motorized and non-motorized) have had on these habitats. For this analysis, the Forest vegetation database was queried through GIS. Roads and trails were given a universal 20-foot width of direct habitat loss. The vast majority of roads on the Forest are 12-14 feet wide. As seen in Figure 3.3.5, rare habitats contribute extremely small acreages to the total Forest Service acres. The most acres of rare habitats were identified in the Madison, Henry's, and Absaroka Beartooth ranges, with 3,489 acres in the Madison. Acreages in the Bridger/Bangtails and Crazy Mountains were very low, and this may be due to some mapping inadequacies for these habitats. These rare types have been mapped in more detail in the Grizzly Bear Recovery Zone, and acres may be reflective of that mapping effort. These rare types probably comprise at most only 1-2% of any one mountain range (Figure 3.3.6).

Figure 3.3. 5 Total acres by mountain range and acres of rare habitats. (Figures are generated by making GIS queries of the TSMRS database (see Cherry 2006 Rare Habitats queries in Project Record), and then dividing the total acres of the mountain range by the acres of rare habitats to get the percentage rare habitat in the mountain range).

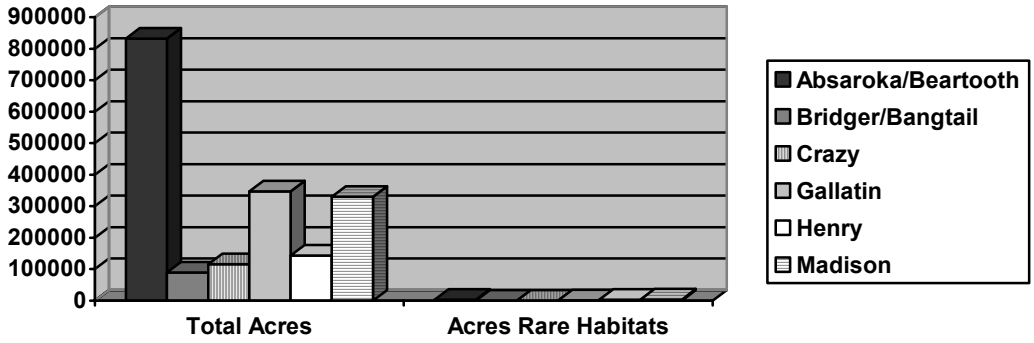
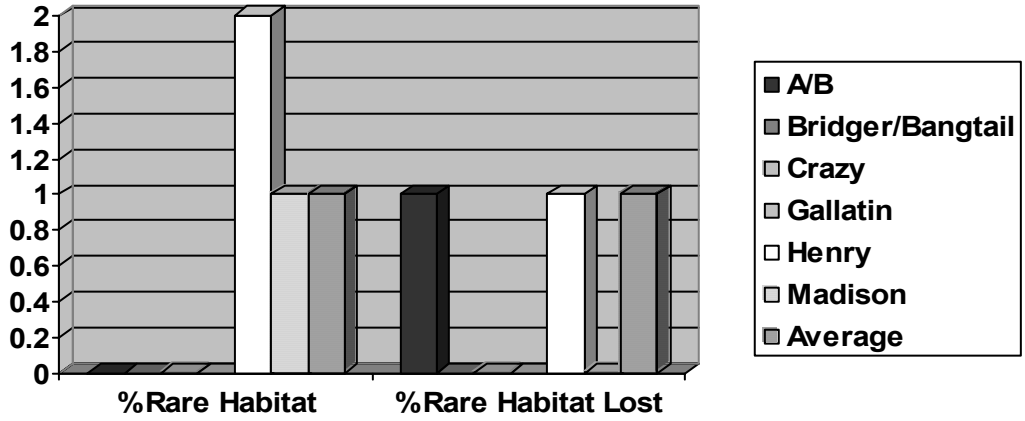


Figure 3.3. 6 Percent rare habitat and percent rare habitat lost to travel routes. (This was calculated by overlaying the existing buffered roads with the mapped rare habitats and determining what percent of the rare habitats in each mountain range was affected by the roads.)



Effects common to all alternatives

As evident in Figure 3.3.6, there are very small percentages of rare habitats in these mountain ranges. Of the 1-2% of rare habitats identified, only up to 1% is affected by travel routes given the buffer used. In other words, the directly affected acreage is very small, with a total of only 60 acres estimated to be affected out of an estimated 10,504 total acres of rare habitats across the Forest. Although the acreage is small, the impact to rare habitats is important. Habitats have already been affected by roads, and there may be little that can be done where these habitats have been lost. A Forest-wide (Goal G in Alts. 2-6 and Goal H in Alt. 7-M) and site-specific analysis of any new routes will allow for avoidance of rare habitats in route location and construction. If rare habitats are noted that have existing routes in them, efforts may be made to reduce or minimize impacts. The alternatives with less travel routes may eventually result in a small increase in these rare types

over time, and the alternatives with more travel routes may result in a small decrease in these rare types. However, when new projects are analyzed through NEPA, mitigation could occur for proposed routes in rare habitats. See Issue 17: Riparian Areas for a more in depth analysis of that habitat.

Cumulative Effects

Specific Cumulative Effects on Corridors

Bear Canyon Corridor

Interstate Highway (I-90) with its parallel railroad track, frontage road and power corridor, is the major impediment to wildlife movement in this corridor. None of the roads contributing to road density fall under the jurisdiction of the Forest Service. Although this 8 sq mi of analysis area has the same fairly low road density under all alternatives, National Forest and private land east of this 8 sq mi area has many motorized routes (although some routes are gated and closed to public use).

North Bridgers Corridor

The northern piece of the North Bridgers TPA consists of a 10 sq mi piece of land more than half of which is in private ownership. It has a motorized route density baseline of 0.85 mi/sq mi under all alternatives of routes over which the Forest Service has no jurisdiction. It should be noted that effects of private land motorized routes on the east side of the mountain range may make wildlife movement north to south and vice versa on this side of the range more difficult than movement on the west side of the mountain range.

Lionhead Corridor

Factors influencing whether or not this area can serve as a wildlife movement corridor are that Highway 20 passes east to west through the southern part of the Lionhead TPA, and that there are large pieces of private land along the west side of the South Fork of the Madison River that are becoming increasingly developed. The Targhee National Forest, which lies to the south of the Lionhead TPA, also has a portion of Highway 20. There appears to be a fairly low motorized route density in most of the rest of this part of the Targhee Forest. Impacts on private land will likely increase with development, and it may become more difficult for wildlife to pass through this area south of Hebgen Lake.

General Corridors

Barriers to wildlife movement are most often caused by wide roads (often highways) that have high speeds and that may have center barriers and/or medians. Roads that have adjacent power lines, frontage roads and/or railroad tracks can be formidable barriers for many wildlife species. These are cumulative effects of the presence of the road corridor. The identified linkage areas for wildlife around the Gallatin National Forest area are primarily located off the National Forest, outside of National Forest jurisdiction, and are therefore cumulative effects.

Ruediger et al. (1999) identified key linkage areas in the Northern Rockies as discussed earlier. Interstate highways that are typically four lanes and often have some type of center barrier, large clearings on either side as well as occasionally in the median, are the roads of most concern. Road segments on or near the Forest that have been identified include Interstate 90 at Bozeman Pass, Highway 191 from Big Sky to Highway 287 junction, Highway 212, (the Beartooth Pass) to junction of Highway 89, Highway 20 from junction with Highway 287 to Idaho border, and Highway 89 in Yankee Jim Canyon (Table 3.3. 5) (Ruediger et al.1999). Whether or not a road is a barrier depends on the species being discussed, but the focus of most discussion in recent years has been wide-ranging carnivores such as wolverine, lynx and grizzly bears.

Table 3.3. 5 Gallatin National Forest key linkage areas (from Ruediger et al. 1999).

Highway Segment	High Priority	Four Lanes	High Traffic Volume	High Potential for Upgrade*	Parallel Railroad	Critical Private Lands
I-90: Bozeman Pass	X	X	X	X	X	X
Highway 191: Big Sky to Highway 287 junction			X	X		
Highway 20 to Highway 287 junction to Idaho border			X	X		
Hwy 89: Yankee Jim Canyon through Yellowstone Park			X	X		
Highway 212: Beartooth Pass to junction with Highway 89	X		X	X		

* Although the paved routes themselves may not have much potential for change, there may be future changes to the types of barriers in the middle of highways and other highway related structures.

The cumulative effects of these highways on wildlife movement may be addressed when there are future highway improvement projects in coordination with the state and federal highway agencies and other interested parties.

The activities occurring on private land near and on the Forest where development and roads are increasing, make wildlife movement more difficult. Some of the areas of concern are the east side of the Bridger Mountains where Bridger Bowl Ski Resort exists and is approved to expand, and where the Brackett Creek land exchange will have the effect of increasing motorized route density in that area. In addition, there is the potential for private land development in the west Bangtails where private land was consolidated.

Net Effects of Past and Present Programs and Activities

The major components of biodiversity affected by programs and activities include wildlife corridors, vegetative diversity, rare habitats, and viability. Biodiversity is most affected by anything that impedes wildlife movement across the landscape, affects vegetative diversity, especially rare habitats, or affects species viability. Many of the impacts of human programs and activities are fairly short term except for a change or reduction of vegetation.

Timber harvest and fire activities are fairly short-term but have longer lasting consequences (see Cherry 2006, Cumulative Effects worksheet for Biological Diversity Issue). Fire suppression has led to the landscape having more older and denser vegetation than would have existed in the normal

fire regime for this area. Timber harvest generally removes the larger, older trees, reducing the potential old growth and mature component of the forest. These affects are long-lasting, however, the effects of timber harvest on biodiversity may not be what many think since humans have suppressed wildfires. Fire suppression has decreased the amount of aspen on the landscape, and has probably affected whitebark pine and other rarer species. The recent efforts to move this area back to a more natural fire regime and reduce unnatural fuel buildup should be beneficial for biodiversity. Attempts to enhance the rarer habitats such as aspen, willow and whitebark pine will be beneficial for biodiversity. Livestock grazing has probably led to a decrease in plant diversity on livestock allotments, and possibly impacts to riparian species in some areas. This has probably decreased biodiversity, at least during the early grazing days.

Travel routes affect biodiversity by allowing for humans to more easily enter the landscape, impact vegetation, spread exotic species, and perhaps impact wildlife movement. Roads and facilities on the landscape reduce habitat available to wildlife and may have some effect on wildlife movement through areas depending on densities.

Mining has had fairly minor effects on biodiversity except where it may have affected water quality and thus aquatic species diversity and survival. There has been habitat loss where large mining operations have occurred, such as the Cooke City area.

Human use can affect biodiversity by concentrating in rare habitats, such as riparian areas, and by displacing wildlife from some areas, potentially affecting wildlife movement. Recreational residence sites remove wildlife habitat and may displace wildlife in those areas having a fairly minor and localized affect on biodiversity. Most of the approximately 200 recreational residences on the Forest are found on Hebgen Lake and Bozeman Ranger Districts. Developed ski areas could potentially affect wildlife, mostly in the winter. Habitats are usually altered, with cover removed, and the size and location of a ski area could influence how animals move across the landscape, especially in winter. Winter is not normally the time of long movements by most wildlife species.

The acquisition of lands and conservation easements on lands that were in checkerboard ownership or adjacent to the Forest is of critical importance to wildlife and has made a huge improvement in the Forest's ability to manage wildlife habitat and protect important wildlife areas from development as well as provide for wildlife movement across the landscape. The flip side of this lands effort has also resulted in large blocks of private land that can be developed adjacent to the National Forest.

Many wildlife species have rebounded from the early efforts of hunting, trapping and predator control. Wildlife in Montana is managed by MFWP with regulated hunting, fishing and trapping regulations with the intent of conserving these species. Legislation such as the ESA has led to protection of threatened and endangered species and has shown success in the delisting of the peregrine falcon, and potential future delistings of the bald eagle, grizzly bear and gray wolf in the Yellowstone area. These species have met their recovery criteria. These recovery actions have benefited biodiversity. The reintroduction of the gray wolf is one of the most interesting things to occur in this area with its subsequent impact on a whole suite of predators as well as prey. Not only are these animals influenced, but apparently there are influences that are occurring on the wildlife habitat as indicated by an increase in riparian vegetation such as willow and aspen. The

maintenance of relatively undisturbed habitats and the reintroduction of species that have been removed from the ecosystem in the past benefit biodiversity.

The Canada lynx was listed as threatened under ESA in 2000, and the Forest Service is using the Lynx Conservation Assessment and Strategy (Ruediger et al. 2000) to guide its management of lynx habitat.

Fisheries management tends to benefit wildlife habitat and biodiversity, especially when riparian areas are improved.

The existence of large Wilderness areas on the Gallatin and adjacent Forests and large protected areas within Yellowstone National Park offers a refuge for many wildlife species sensitive to the presence of humans. This has led to the presence of a high percent of habitat that is non-motorized and where wildlife is relatively undisturbed by large numbers of people.

Projected Combined Effects of Reasonably Foreseeable Programs and Activities

Future vegetation management projects will be more tied to fuels reduction and will tend to be patchier in nature, leaving some structure for wildlife in burned or harvested areas. The increase in use of prescribed fire on the landscape should be beneficial to wildlife in this fire dependent ecosystem where fire has been somewhat successfully excluded in the last 60 years. A return to a more normal fire cycle and regime will be beneficial to wildlife and biodiversity.

Improved range management practices and monitoring of range condition will improve wildlife habitat and biodiversity. Control of noxious weeds is important for maintaining high quality wildlife habitat and biodiversity. Efforts to restore native vegetation to the landscape or enhance species that are declining are beneficial to biodiversity.

Minerals activity is unpredictable. Future activities on the forest would have to go through NEPA. Smaller mine operations have fairly minor effects, but larger operations could affect wildlife movement, vegetation, and perhaps water quality and aquatic diversity.

Future work on FS roads and trails may increase the impact of these facilities to wildlife by encouraging greater use by a wider range of vehicles and increasing vegetation loss and perhaps spread of noxious species. Other routes will be decommissioned, which will benefit wildlife and biodiversity in general.

An increase in dispersed use in which many of the dispersed users are interested in wildlife may actually be somewhat detrimental to the resource they wish to see, photograph, or hunt. Additional education of the public on their wildlife resource is important so that wildlife habitat and biodiversity are protected. Increasing public use will decrease the ability of wildlife to fully occupy available habitat, and some species are more likely to be affected than others. The number of recreation residences is not expected to increase in the future, and although there may be some modifications, their impacts will be about the same as they are at present. Outfitter/guide activity may increase, particularly for somewhat less traditional uses such as kayaking, wildlife watching,

and photography. There are likely to be some minor impacts to wildlife. There will be some new impacts from ski area expansions which consist of a loss of vegetation and more humans utilizing the area in the winter.

The Forest will continue to acquire appropriate lands and conservation easements that will have an overall beneficial effect for biodiversity, particularly wildlife movement.

Requests for special uses permits for non-recreational uses will continue. The main concern would be during the construction phases of the projects and then afterward if any motorized access routes are created. All of these requests will go through site-specific NEPA.

The future amendment of the Conservation Strategy for Grizzly Bear to the Forest Plans in the GYA and the Lynx amendment will help assure the conservation of these species and likely have beneficial effects on other species and be beneficial for biodiversity.

Future fisheries habitat enhancement will be of benefit to biodiversity, especially when riparian areas are improved.

Working with the highway departments on wildlife passage is important. Requests to access private land across the National Forest are likely to continue and must be granted in most cases. These projects will have to go through NEPA.

Implementation of the Gallatin National Forest's travel management plan should reduce motorized routes on the Forest and thus increase non-motorized habitat for wildlife and increase biodiversity. Other Forests are also undergoing travel management planning, either by district or Forest. The trends are similar on other Forests.

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

Alternative 1
The cumulative effect of Alternative 1 with other programs and activities is likely to have a greater impact on biodiversity than the other alternatives, primarily by allowing the proliferation of current travel on the Forest, allowing off-route use, and not designating travel routes. In addition, project roads may remain open to the public and administrative routes may not all be gated. This alternative will lead to the continuing increase in new routes, allow off-route travel, which will have the effect of higher route densities which may affect wildlife movement and reduces habitat availability, and more vegetative disturbance and introduction of exotic species which affects vegetative diversity. In addition, new routes could come into use that affect rare habitats such as potential old growth, aspen, willow, whitebark pine and other important habitats.

Alternatives 2 through 7-M
Alternative 2 is a 'snap shot' of current travel on the Forest with the OHV Rule in effect. Under Alternatives 2 through 7-M, project routes are expected to go out of use over time, and administrative routes are generally closed to the public (although some may allow ATV/motorcycle use). Future routes will go through NEPA analysis. There is little difference among Alternatives 2

through 7-M for the corridor portion of the biodiversity issue. The main benefit of implementation of a travel plan is gaining control of the travel system on the Forest, closing routes that should be closed and maintaining routes that stay open, and not having off route vehicles or the proliferation of new routes. Weed control efforts can be somewhat more limited since there will be less motorized access on the Forest. Rare habitats, especially potential old growth, that are already affected will remain that way, at least for some time, but may begin to revegetate once closed. Vegetative succession for potential old growth takes long enough that little change in this vegetative component that no increase in potential old growth is expected. Other rare habitats, such as willow and aspen may show fairly rapid vegetative succession in a relatively short period of time once routes are closed. Of Alternatives 2 through 7-M, those that have the least motorized travel routes (5, 6, and 7-M) are the best for maintaining biodiversity on the Forest.

Cumulatively, many of the past, present and future management actions on the Gallatin National Forest have or will improve or maintain biodiversity over the current condition. Rare habitats that have been lost to access routes will either remain that way or be restored over time if routes are closed (see Goal H and Guidelines H-2 and H-3). There are large pieces of secure habitat found in the National Parks and Forests in the Yellowstone area. Alternatives 5, 6 and 7-M offer the most protection to the areas identified as corridors for wildlife, although North Bridgers is the same in Alternatives 2 through 7-M. Most impacts to biodiversity are from cumulative effects on private lands, and are not from the actions of the Forest Service or other agencies. The impact of the growing human population and associated development poses the greatest risk to human development on the Forest.

Effects of Proposed Goals, Objectives, Standards and Guidelines

Alternatives 2 through 7-M propose a number of goals and objectives to provide for recreation opportunity, access and to improve other resource conditions that may have been adversely affected by the Forest's transportation system. Goals and objectives, by themselves, have no environmental effect because they do not constitute final agency decisions. Environmental effect under NEPA is more appropriately addressed at such time that specific actions are proposed to achieve these goals and objectives. The proposed Travel Management Plan does include the final agency decisions for management of public travel and this reflects implementation of the goals and objectives proposed for recreation opportunity (for example Forest-wide Goal A, Objective A-1, and Travel Planning Area Goals 1 and 2 and Objectives 1-1 and 2-1). The predicted direct, indirect and cumulative effects of public travel on Biodiversity, and hence the implementation of these goals and objectives are addressed earlier in this section.

Alternatives 2 through 7-M also propose standards and guidelines to provide for protection of other resources during Travel Plan implementation. Standards and guidelines include protection measures within which future proposals for road and trail construction, reconstruction, maintenance and decommissioning must take place. These are considered final agency decisions because they set limitations within which future actions must take place.

The proposed goals, objectives, standards and guidelines that are relevant to the protection and improvement of Biodiversity are discussed below.

Where Alternative 7-M differs from Alternatives 2-6, it is noted below in parentheses. The benefits to biodiversity accrue through the implementation of any alternative which designates routes, places the Forest under the Montana/Dakota OHV EIS and generally reduces motorized routes and protects wildlife habitat. There is a goal for wildlife corridors (Goal E in Alternatives 2-6 and Goal F in Alternative 7-M) which are specifically addressed in this issue. Other items are more general but benefit biodiversity by protecting or enhancing habitat for wildlife and/or fish, protecting rare habitats or rare species, promoting connectivity, or reducing human impacts. Additional comments on how this direction affects biological diversity appear below in italics.

Proposed Forest-wide Direction, Alternatives 2-6 and 7-M

Standard A-6. Off-route travel. Wheeled motorized vehicle travel shall be prohibited off of designated routes with the following exceptions. (This standard and the following exceptions under Alternatives 2-6 become Standard A-8 in Alternative 7-M. There are slight modifications of wording in the exceptions from Alts. 2-6 to Alt. 7-M.) *This standard is beneficial to many species of plants and animals by limiting almost all use to designated routes with minor exceptions, rather than allowing off-route use.*

GOAL C. Resources (General). Manage a system of roads and trails and associated public use that is consistent with Forest Plan goals for water quality; wildlife habitat; fish habitat; threatened and endangered species recovery; and historical resources (Note: Until Forest Plan revision refer to Forest Plan (9/87), pages II-1, II-2, and Amendment 19). (This Goal under Alternatives 2-6 becomes Goal D in Alternative 7-M, and the following objectives remain the same.) *This goal is beneficial to many species and their habitats on the Forest by allowing uses consistent with water quality, wildlife habitat, fish habitat, etc.*

> **OBJ. C-1. Road Rehabilitation.** Close and rehabilitate existing roads that are in excess to administrative, recreation and access needs. (This objective becomes **Objective D-1** under Alternative 7-M.) *This objective reduces the amount of roads and their effects on the landscape to biodiversity.*
>
> **OBJ. C-2. Trail Rehabilitation.** Close and rehabilitate existing non-system trail not otherwise designated for public travel. (This objective becomes **Objective D-2** under Alternative 7-M.) *This objective reduces impacts of humans on the landscape.*

GOAL D. Fisheries. Manage a road and trail system that fully supports the beneficial use of growth and propagation of salmonid fishes and associated aquatic life. This is followed by a number of objectives. (In Alternative 7-M, Goal D becomes **Goal E. Water Quality, Riparian, Fisheries and Aquatic Life** with numerous objectives, standards, and one guideline.) *The protection of water quality, riparian habitats, fisheries and aquatic life is essential for maintenance of biodiversity, and the language in Alternative 7-M is an improvement over the language in Alts. 2-6.*

GOAL E. Wildlife Corridors. Provide for wildlife movement and genetic interaction (particularly grizzly bear and lynx) between mountain ranges at Bozeman Pass (linking the Gallatin Range to the Bridger/Bangtails); in the North Bridgers (linking the Bridger Range to the Big Belt Mountains;

across Highway 191 from Big Sky to it's junction with Highway 287 (linking the Gallatin and Madison Mountain Ranges); the Lionhead area (linking the Henry's Lake Mountains to the Gravelly Mountains and areas west); Yankee Jim Canyon (linking the Absaroka Mountains to the Gallatin Range); and at Cooke Pass (linking the Absaroka/Beartooth Range to areas south). *This goal and TPA specific objectives help protect and allow for movement of wildlife between mountain ranges.* Under Alternative 7-M, Goal E becomes **GOAL F. Wildlife Corridors**, and it is worded differently. Provide for wildlife movement and genetic interaction (particularly for wide-ranging species) between and within mountain ranges throughout the Gallatin National Forest and connecting wildlands. **OBJ. F-1.** Provide habitat connectivity consistent with wildlife movement patterns between mountain ranges such as that at Bozeman Pass (Linking the Gallatin Range to the Bridger/Bangtails); the North Bridgers (linking the Bridger Range to the Big Belt Mountains; the Lionhead Area (linking the Henry's Lake Mountains to the Gravelly Mountains); the Shields (Crazy Mountains to the Castle and Little Belt Mountains) and any additional linkage or wildlife movement corridors recognized by the Forest Service.) *The language change between Alts. 2-6 and 7-M is an effort to move all of the direction into Forest-wide direction, and allows recognition of the potential addition of new corridors in the future. It also names the corridors that seem to be important connections among mountain ranges and deletes a few of the corridors that are currently less well documented. Corridors are recognized as essential parts of maintaining biodiversity by allowing wildlife movement and allowing wildlife populations to be as connected as they have been in the past.*

GOAL F. Threatened, Endangered and Sensitive Wildlife Species. Manage human use of the Forest road and trail system that allows for the recovery of threatened and endangered species and maintains sensitive species and their habitats. (This becomes **Goal G. Threatened, Endangered and Species of Special Management Designation**. This wording change from Sensitive Species to Species of Special Management Designation allows for the potential change of designations of species that the Forest manages under the New Planning Rule such as Special of Concern.) *This goal helps protect and recover T&E and other rare species and their habitats which is essential for biodiversity*

> **OBJ. F-1. Grizzly Bear Recovery.** Within the grizzly bear recovery zone reduce total summer motorized access route density and increase core (secure) habitat, consistent with the Grizzly Bear Conservation Strategy, within subunits Gallatin #3, Henry's Lake #2 and Madison #2. Provide effective closures on access routes not designated for motorized use. (In Alts. 2-6.) (Under Alternative 7-M **Objective G-1** is: Provide effective closures on access routes not designated for motorized use. Grizzly Bear subunits Gallatin #3, Henry's Lake #2, and Madison #2 and non-designated routes that are attractive to motorized use within secure grizzly bear habitat should receive high priority.) *This helps assure that priority is given to closing routes in important grizzly bear habitat.*
>
> **OBJ. F-2. Grizzly Bear Recovery.** Provide for no human-grizzly bear interaction that results in personal injury or bear mortality. Provide all visitors to the trail system of the Gallatin National Forest with information on proper food storage and safe recreation use. (In Alts. 2-6.)

STANDARD F-1. Grizzly Bear Recovery. Within the grizzly bear recovery zone (as described in Gallatin Forest Plan, 9/87), any new motorized route constructed and used for administrative or other purposes will be offset by closure of another open motorized route of equal or greater length within the same bear management subunit. (This standard is applicable to Alternatives 2 through 6 and is based on Amendment 19 of the 1987 Gallatin National Forest Land and Resource Management Plan (1995) that established certain requirements for the protection of the threatened grizzly bear.)

STANDARD F-2. Lynx. In accordance with the Lynx Conservation Strategy there shall be no net increase in any groomed or marked snowmobile or ski routes or designated play areas on the Gallatin National Forest. (This standard applies to Alternatives 2 through 6. The standard would mean that there could not be a net increase in groomed or marked routes or play areas once the travel planning decision has been made. This standard does not exist in Alternative 7-M).

Under Alternative 7-M, Guidelines G-2 Species of Special Management Designation, and **Guideline G-3, Threatened and Endangered Species** are brought into the EIS. Under **G-2**, new proposed routes are located to avoid important habitats of Species of special management designation, and mitigation measures are suggested. **Guideline G-3** for T&E species allows for temporary localized restrictions to prevent conflicts with T&E species.

In addition to the proposed programmatic direction, travel management under Alternative 7-M would follow current direction applicable to the management of grizzly bear and lynx. At the time of this EIS publication, the applicable direction is based on Memorandums of Understanding (MOU's) and Conservation Agreements (CA) with the United States Fish and Wildlife Service (USFWS). See MOU, Conservation Strategy (ICST 2003:12-13), the USFWS Biological Opinion on Access (1995), and Canada Lynx Conservation Agreement (2005). *Alternative 7-M, by following current direction for grizzly bear and lynx and by that wording allowing the Grizzly Bear Conservation Strategy for Grizzly Bears in the GYA and the Northern Rockies Lynx Amendment to become our current direction as these decisions are made, benefits these T&E species by using the best science and current information in their management.*

GOAL G. Wildlife. Provide for healthy vegetative conditions in key habitats such as willow, riparian, wetlands, whitebark pine, and potential old growth. (This becomes **Goal H. Wildlife** in Alternative 7-M, and several other key habitats are enumerated.) *Maintaining key habitats, which host more species than other habitats, is important for maintaining biodiversity.*

OBJ. G-1. Strive for no unclassified, undesignated roads and trails within key habitats that have been damaged or is devoid of native vegetation due to motorcycle, ATV, horse or foot use. (This Objective is dropped from Alternative 7-M, and **Guidelines H-1 and H-2** were added. **H-1**. Relocate, reconstruct or take other appropriate action on system roads and trails that are found to have adverse impacts on key habitats. **H-2**, Roads and trails should be

located to avoid key habitats or mitigate the impacts.) *Maintaining key habitats that are important for many wildlife species, is key to maintaining biodiversity.*

GOAL H. Wildlife. Provide high quality security habitat in areas important to wildlife reproduction (e.g. calving, fawning, denning and nesting habitat). (This becomes **Goal I** in Alternative 7-M.) *Protection of reproductive habitats is important for biodiversity*

OBJ. H-1. Minimize stress factors from human recreation use to species of concern during calving, fawning, denning and nesting seasons in habitats used for reproduction. See specific travel management area direction. (This becomes **Guideline I-1** in Alternative 7-M.)

GOAL I. Wildlife. Provide high quality security habitat on important ungulate winter range. (In Alternative 7-M this was consolidated into Goal H.)

OBJ. I-1. Ungulates. Eliminate stress factors from human winter recreation use to ungulates in important winter range areas. (This Objective is part of Objective I-1 in Alternative 7-M.) *Although ungulates tend to be common species, providing security on big game winter range also benefits other species that occur there*.

Guideline I-2. This is new under Alternative 7-M and states that in management of winter travel should consider MFWP goals for optimal survival on big game winter ranges.

Alternatives 3 and 7-M both have language regarding the consideration of backcountry airstrips. Basically, proposals for airstrips (airplane and helicopter) will be considered and must go through NEPA analysis and would be under special use permits. Under Alternative 3, a number of airstrips are proposed. Under Alternative 7-M, backcountry airstrips for public recreational use will not be considered in designated Wilderness, the Hyalite/Porcupine-Buffalo Horn Wilderness Study Area, the Cabin Creek Recreation Wildlife Management Area, the Lionhead and Republic Mountain Recommended Wilderness Areas, or within the Grizzly Bear Recovery Zone. For biodiversity, it is preferable not to allow airstrips at all, but if allowed, Alternative 7-M, which restricts some areas for this activity, is preferable over Alternative 3.

In Alternatives 2-6, there were additional categories of Administrative Uses and Road and Trail Construction, Reconstruction and Maintenance for Forest Plan direction. These do not exist under Alternative 7-M, but are meshed with other Goals, Objectives, Standards and Guidelines.

Overall, the modifications of Goals, objectives, standards and guidelines that occur from Alternatives 2-6 to 7-M are more clear and concise and more of them become Forest-wide. The wording in 7-M is preferable over that in the other alternatives for the Biodiversity issue.

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

The National Forest Management Act (NFMA) of 1976 and the subsequent 1982 planning rule mandate the maintenance of viable populations of all native and desired non-native species of vertebrates (36 CFR 219.19). The Gallatin Forest Plan (p. II-1) also has a Forest-wide goal of providing habitat for viable populations of all indigenous wildlife species. A viable population is defined as *"one which has the estimated numbers and distribution of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area"* (NFMA). The Act also states, *"fish and wildlife habitat shall be managed to maintain viable populations."* The planning area has been defined as the area covered by the Land and Resource Management Plan. This is the basic direction that the Forest Service has on biodiversity and viability.

The Canada Lynx Conservation Assessment and Strategy (LCAS) is currently the document with the most direction on key linkage areas. There are standards for federal lands that would protect key linkages (corridors) and avoid creation of barriers to movement (Ruediger et al. 2000:7-14, 7-15). The linkage across Bozeman Pass was identified as a key linkage in the mapping effort resulting from the LCAS. The Northern Rockies Lynx Amendment EIS, which will amend the Forest Plans, when finalized, may contain additional direction on linkages.

The current condition for travel management, Alternative 1, which allows for a proliferation of motorized use, does not limit motorized use or cross-country use, does not meet the above direction if allowed to continue. Motorized creep would occur with many more user guilt routes and double track routes appearing throughout the Forest. Alternative 1 could threaten the viability of some species in the future.

Alternatives 2 through 7-M take positive action by removing project roads from public use and limiting cross-country routes as well as designating routes. The alternatives that take the strongest measures to limit motorized use and protect connectivity are the alternatives that best meet this direction relevant to biodiversity. These are Alternatives 5, 6, and 7-M.