ISSUE 2: BIG GAME (UNGULATES)

Changes from the Draft to the Final EIS

Following is a summary 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) and the analysis and comparison of alternatives reflects this change.
- In the Draft EIS, a forest-wide aggregation of direct and indirect effects of various alternatives was included in the Cumulative Effects section for this issue, because the spatial analysis unit for direct and indirect effects was defined as the individual Travel Planning Area (TPA). For the Final EIS, this forest-wide summary of impacts was moved to the direct and indirect section, even though the spatial analysis units remained the same. It was determined that travel-associated effects were best discussed in terms of direct and indirect effects, and that a forest-wide summary was useful in terms of comparing alternatives for overall impacts, as well as distribution of impacts across the landscape.
- 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 (Schacht 2006).
- 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

The Gallatin National Forest provides important habitat for numerous species of big game animals including elk, moose, deer, bighorn sheep, antelope, bison, and mountain goats. The Forest Service is responsible for managing habitat for big game animals on the Forest. Big game populations on the Forest, especially those of elk, are an extremely important recreational and economic resource in southwest Montana. There is a large amount of local and national public interest in big game populations on the Forest, where both big game hunting and wildlife watching are very popular activities.

Various types of travel may cause disturbance and displacement of some big game species from important summer and winter habitat, resulting in lower big game populations. Management of motorized travel on the Forest could also affect the vulnerability of elk to hunting, leading to low mature bull elk numbers and possibly restricted hunting opportunities.

Affected Environment

Elk

Elk are found throughout the Gallatin National Forest. They utilize nearly all habitats over the course of an annual cycle, from low elevation sagebrush/grasslands in winter to subalpine forests

and meadows in summer. Elk populations on the Forest are managed by the Montana Department of Fish, Wildlife and Parks (MFWP) to provide for a sustained yield of surplus animals for hunters, along with viewing opportunities for the public. While the Forest Service has no management authority for elk populations, it does have an important responsibility to provide habitat for elk, because most summer range for the affected elk herds is located on the Forest along with portions of several key winter ranges. The Gallatin Forest Plan identifies elk as a management indicator species (MIS), or a species whose habitat is most likely to be affected by Forest management activities, for big game (USDA 1987:II-18, 19). Populations are to be monitored for change to determine the effectiveness of Forest management activities. The Gallatin National Forest provides a large amount of high quality elk habitat, and elk populations are currently above objectives set by MFWP in most areas of the Forest. One exception is the Upper Gallatin herd (Cherry 2002:5) that summers in the Gallatin Range, mostly in Yellowstone National Park, and migrates to winter ranges in the Yellowstone River Drainage, in the Gallatin Mountains, both inside and outside Yellowstone National Park (primarily Taylor Fork And Porcupine), and winter ranges in the Madison Valley. The Northern Yellowstone elk herd has also exhibited a downward trend since 2001 (Smith et al. 2003:336).

Moose

Moose are found in many areas across the Forest, but are generally more selective in the habitats they utilize than deer or elk. Willow-lined riparian areas, aspen stands, subalpine fir forests, and moist high-elevation meadows are some key habitats for moose, with willows and forests with subalpine fir understories of particular importance during winter due to the browse that they provide. Moose occur in relatively low densities and are difficult to count; therefore, population data in the area are limited (Tyers 1999:73). However, enough data exists to determine that moose populations in some areas of the Forest such as the Northern Yellowstone Range, Upper Gallatin and Hebgen Basin have declined substantially since the 1980s, while in other areas they have remained stable. The effects of summer travel on moose habitat were not identified as an issue, and the literature is largely silent on this topic. Therefore, only the effects of winter travel on moose habitat were analyzed.

Bighorn Sheep

Bighorn sheep are one of the least common big game species on the Forest. Although they are native to southwest Montana and were probably abundant prior to European settlement, they are now much more restricted in distribution and fewer in number primarily as a result of over-harvest in the late 1800s and early 1900s, as well as competition with domestic livestock and the diseases they transmit (Legg 1999:5). Their habitat requirements are much narrower than those of deer and elk, due partly to their need for rocky, steep terrain for escape from predators (Lawson and Johnson 1982:1041). Bighorn sheep on the Forest typically migrate between alpine areas in the summer and lower-elevation or wind-blown areas with shallow snow in the winter. Currently, they are found in the Beartooth, Absaroka, Gallatin, Madison and Henry's Lake Mountain Ranges within the Forest. Most populations have not been stable, and have periodically crashed due to disease outbreaks. Because bighorn sheep typically are found in high elevation areas with low motorized route density during the summer months, summer travel was not identified as an issue and only the effects of winter travel were analyzed for this species.

Mountain Goats

Mountain goats on the Gallatin National Forest are descended from animals transplanted by the State of Montana during the mid-twentieth century. Goats generally responded well to these transplants. They have increased their distribution into most areas of suitable habitat and are now found in all of the mountain ranges on the Forest (Varley 1999:87). Goat habitat typically consists of steep, rocky terrain where they can find forage yet quickly escape from predators. In summer, this is usually alpine habitat while in winter they move to lower-elevation, wind-blown locations where they have access to forage. Because goats typically are found in high elevation areas with low motorized route density during the summer months, summer travel was not identified as an issue and only the effects of winter travel were analyzed for this species.

Mule Deer

Mule deer are another common big game species found in almost all habitats and throughout most of the Forest at some time during the annual cycle. There is a large amount of overlap in habitat between mule deer and elk. Impacts of travel management on the Forest are expected to be very similar for both elk and mule deer, and a detailed analysis was conducted for elk. Therefore, mule deer will not be discussed further.

White-Tailed Deer

White-tailed deer are relatively uncommon on the Forest. In southwest Montana, they are closely associated with lower-elevation valley bottoms and agricultural fields that are generally found on private lands. For this reason, travel management on the Gallatin National Forest has little potential to affect this species and they will not be discussed further.

Antelope

Antelope habitat, like that for white-tailed deer, is limited on the Forest. Antelope are found exclusively in open, sagebrush-grassland landscapes that are mostly below the lower elevation limits of the Forest. Most antelope habitat in southwest Montana occurs on private and state lands. For this reason, travel management on the Gallatin National Forest has little potential to affect this species and they will not be discussed further.

Bison

Bison from Yellowstone National Park periodically migrate outside the Park and onto the Gallatin National Forest in the Gardiner and West Yellowstone areas. However, because some bison in the Yellowstone area are infected with the disease brucellosis, they are intensely managed by the disease and wildlife management agencies on National Forest lands to prevent transmission of this disease to domestic cattle. For this reason, travel management on the Gallatin National Forest has little potential to affect this species and they will not be discussed further.

Elk Habitat Use and Summer Travel

Although winter is a time of obvious stress to elk and other ungulates, the importance of adequate summer habitat has received growing recognition from biologists. This is the period during which they must have access to adequate forage to build fat stores sufficient to allow them to survive the next winter. Summer nutrition plays an important role in the ability of cows to produce healthy calves (Canfield et al. 1999:6.9). Disturbance from human activities has the potential to displace them from preferred habitats during these critical periods, thus compromising their ability to survive and reproduce, potentially affecting populations (Canfield et al. 1999:6.11).

Many studies have shown that motorized access influences elk habitat use (Lyon 1983:592, Frederick 1991:19, Lyon and Christensen 2002:567). Elk have repeatedly been shown to avoid habitat adjacent to open roads (Lyon et al. 1985:6). Declines in habitat use have been reported within 0.25-1.8 miles of open roads (Lyon and Christensen 2002:567), but substantial reductions in habitat use are normally confined to <0.5 miles of an open road. Many variables influence elk habitat use relative to open roads. Avoidance of open roads was greatest when less cover was present, during the hunting season when use of Forest roads peaks, and on high-standard primary roads (Lyon et al. 1985:6). Topography also influences elk habitat use near roads (Frederick 1991:22).

Observed declines in habitat use adjacent to roads have led to the development of elk habitat effectiveness models. Habitat effectiveness refers to the percentage of available habitat that is usable by elk outside the hunting season (Lyon and Christensen 1992). A variety of elk habitat effectiveness models have been produced for different habitats in the western United States, but a common variable is open road density. Although restricted roads (those roads which are gated or otherwise physically blocked to prevent public motorized use during all or portions of the year) may still cause an avoidance response by elk (Lyon 1979:8), avoidance is normally much lower when compared to open roads (Lyon et al. 1985:3, Frederick 1991:26, Lyon and Christensen 2002:568). This is why open road densities are normally used rather than total road densities (which include both open and restricted roads) in habitat effectiveness models.

The literature contains several recommendations for managing open roads within summer elk habitat. Using Lyon's model for habitat effectiveness based entirely on road density (Lyon 1983), Christensen et al. (1993:2-3) recommended that habitat effectiveness should be 70% or greater (open road density <0.7 mi/sq mi) for areas intended to benefit elk summer habitat and retain high use. Areas where elk are one of the primary resource considerations should have habitat effectiveness of 50% or greater (open road density <1.9 mi/sq mi).

Areas with <50% habitat effectiveness (>1.9 mi/sq mi) were expected to make only minimal contributions to elk management goals (Christensen et al. 1993:2). Additionally, Canfield et al. (1999:6.12) recommended that open road densities should be less than 1.0 mi/sq mi in big game summer habitat, with scattered key areas with no roads. However, the Statewide Elk Management Plan for Montana does not contain objectives or recommendations for management of open road density within summer elk habitat (Youmans 1992:14-16).

Most studies involving the effects of motorized uses on elk involved roads with passenger vehicle use rather than motorized trails where ATVs and/or motorcycles are used. Therefore, there is very little data available to use in assessing the impacts of motorized trails on elk. Wisdom et al. (2004:7) discussed preliminary findings from a controlled experimental study evaluating the effects of ATVs, mountain bikes, hiking, and horseback riding on elk and mule deer. Their initial results indicate that elk exhibited much higher rates of movement (or greater displacement) and probability of flight response from ATVs and mountain bikes compared to horses and hikers. Canfield et al. (1999:6.16-6.17) and Toweill and Thomas (2002:808) both state that the effects of open motorized trail use are likely similar to those resulting from open roads. The two uses are similar in that both allow easier access to areas that would otherwise be inaccessible without considerable effort using non-motorized transportation. Therefore, travel route densities incorporating motorized trails cannot be compared to published habitat effectiveness models, but they can be used to compare Travel Plan effects among alternatives. As with open road density and habitat effectiveness values, the existing literature does not identify a clear link between open motorized route densities and elk population demographics. Therefore, conclusions on expected travel planning impacts can only address disturbance and displacement of elk from summer habitat and not population responses.

Elk Vulnerability and Summer Travel

In the decades after World War II, the Forest Service responded to growing demand for timber by building extensive road systems to facilitate timber harvest on many areas of National Forest. By the 1970s, biologists began to see that access afforded by extensive road systems led to excessive hunting mortality of adult bulls. In some cases, declines in elk populations caused by low calf production were found to be the result of low mature bull/cow ratios (Canfield et al. 1999:6.14-6.15, Stalling et al. 2002:767).

Studies were conducted to determine factors influencing elk vulnerability to hunting and management solutions to the problem of low mature bull elk numbers. One of the conclusions was that motorized access is one of the major factors influencing elk vulnerability, along with hunter numbers, availability of security cover, topography, hunting season structure and length, hunting equipment technology and others. Data have consistently shown that elk mortality rates increase with increasing open road density, because the number of hunters and their distribution both tend to increase with increasing road density (Skovlin et al. 2002:551-553). This is especially true for bulls because hunting regulations have traditionally allowed greater opportunity for harvesting them compared to cows (Vore and Desimone 1991:23).

Motorized access is one of the few factors affecting elk vulnerability that the Forest Service has management authority for (Christensen et al. 1992:4). Most other methods of reducing bull elk mortality must be implemented by state wildlife agencies, and have included restricting hunting opportunity by shortening seasons and increasing the complexity of regulations (Stalling et al. 2002:762, 776-780). Hillis et al. (1991:40) provided guidelines for managing elk habitat to limit elk vulnerability. The key concept was to provide security areas for elk during the hunting season where they are less vulnerable to harvest. They defined secure areas as >250 acres in size and >0.5 miles from an open road, and recommended that they comprise >30% of the analysis unit. Although open roads have the largest effect on elk vulnerability, restricted roads also have an impact because they provide easier access for hunters using non-motorized transportation (Skovlin

et al. 2002:553). Lyon and Burcham (1998:5) found that elk hunters are likely to use closed roads to access areas farthest from open roads. The Hillis guidelines for secure areas included a recommendation to minimize closed roads within elk security areas, but did not provide standards for accomplishing this (Hillis et al. 1991:39). The 30% secure habitat level should be viewed as the minimum necessary to avoid excessive bull elk mortality during the hunting season, realizing that more may be necessary in some districts, due to variables such as topography, vegetation cover and hunting pressure.

The Statewide Elk Management Plan for Montana gives goals for bull/cow ratios and general habitat management strategies for each Elk Management Unit (EMU) (Youmans 1992:74, 77, 80, 95, 132-133, 135-136). The desire to improve elk security was cited for portions of the Bridger, Gallatin, Madison, and Crazy Mountain EMUs (although site-specific recommendations for improvement were not made), while maintaining the current level of elk security was emphasized for the Absaroka and Emigrant EMUs. The six elk management units on the Forest are currently achieving bull/cow ratio goals (Cherry 2002:6), although these goals were often relatively low (T. Lemke, MFWP, personal communication).

Winter Travel and Big Game

Wildlife managers have traditionally focused on providing winter habitat for big game. Winter is the time of year when energy expenditure invariably exceeds intake, due to increased metabolic demands and energetic costs of locomotion, coupled with decreased forage quality and availability. Under such conditions, ungulates typically lose a substantial percentage of their body weight. Severe weight loss leads to increased risk of mortality through starvation and predation, and lower production and survival of calves the following spring. Humans can exacerbate these impacts through winter travel. Disturbance can cause animals to run through deep snow, which is very energetically demanding (Clark 1999:24). Animals that do not flee often exhibit an increased heart rate, which may result in elevated energy expenditures. Lastly, animals may be displaced from important wintering areas to lower-quality habitats, thus reducing their chances of survival and successful reproduction (Canfield et al. 1999:6.7, 6.8).

All types of human activity, including both motorized and non-motorized travel, can cause disturbance and displacement of wintering big game. The literature shows a broad range of conclusions regarding the impacts of different types of uses (Canfield et al. 1999:6.7). The type of use may be less important than the frequency and predictability of the use. Generally, big game is most affected by unpredictable activities such as off-trail snowmobiling or skiing, and light use of snowmobile or ski trails (Cassirer 1992:379-380, Clark 1999:24, Tyers 1999:80-81). They tend to habituate to predictable activities occurring on well-used routes at regular intervals (Aune 1981:88), because this is energetically less costly than fleeing. Off-trail travel was deemed potentially the most detrimental because it occurs over larger areas and is less predictable than use of designated routes (Clark 1999:24). However, off-trail use may have limited impact on wintering animals if use levels are low enough simply because they are rarely disturbed.

While all big game species are potentially affected by winter travel, some species are more at risk than others. Moose are among the most likely to be affected, because they often winter at higher elevations where there is adequate snow cover to support winter recreational use by humans. In

addition to the greater likelihood of experiencing disturbance from human activities than in areas with shallow snow, energetic costs of fleeing from disturbance are much greater in deep snow (Tyers 1999:82).

Although they may readily habituate to human presence under certain circumstances, bighorn sheep may also be rather sensitive to disturbance from human activity (Stemp 1983:262-263, Legg 1999:6-7). Bighorn sheep have specific winter habitat requirements, and as a result, suitable winter range is normally much less abundant than for most other big game species. Sheep displaced from high-quality winter range due to disturbance are frequently forced to use sub-optimal habitat.

Similar to bighorn sheep, mountain goats are generally found in very restricted winter habitats. Mountain goats probably winter in the harshest environments of any big game animal on the Forest (Chadwick 1983:106), and therefore have the least margin for unnecessary energy costs without impacts on survival and reproduction. Although they are found in inaccessible locations where human travel may be unlikely (Varley 1999:91), improved snowmobile technology now allows human access to areas of mountain goat winter habitat that previously could not be reached. Therefore, goats may be increasingly vulnerable to disturbance from winter travel.

Many elk on the Forest winter in areas with low snow cover that are not conducive to winter recreational travel. Energetic costs of disturbance are also lower in these areas than in places with deep snow. Although for these reasons elk may be less susceptible to some types of disturbance such as snowmobiling or skiing (Clark 1999:25) than some other big game species, there remains the potential in many areas for elk to be negatively impacted by winter travel.

Direct and Indirect Effects

Analysis Methodology

The analysis area for direct and indirect effects of summer and winter travel was those portions of MFWP's elk and deer hunting districts within the Gallatin National Forest boundary (Figure 3.2. 1). Hunting districts were chosen because they are relatively large areas, managed by MFWP to accomplish objectives specific to that area, and they are consistent with recommendations for scale of analysis by Christensen et al. (1993:3). Additionally, hunting opportunity is very important to the public, it could be affected by Forest Service travel planning decisions, and these opportunities are managed in these units. The no action alternative is represented by Alternative 2.

Elk Habitat Use and Summer Travel

Open road densities were calculated to compare the alternatives with recommendations from Christensen et al. (1993:3) for open road densities in summer elk habitat. Most of the research used to develop these recommendations was conducted more than 10 years ago and did not study the effects of motorized trails. The use of motorized trail vehicles such as ATVs and motorcycles has increased in that time. Although data are limited, many biologists now feel that the effects of motorized trails on elk habitat are similar to those of open roads (Canfield et al. 1999:6.16-6.17, Toweill and Thomas 2002:808). Preliminary results of a study in progress support this assertion (Wisdom et al. 2004:7). Therefore, open motorized route densities were also calculated and

compared among alternatives. Open road and open motorized route densities were calculated first using only Forest Service routes and again using all routes (Forest Service and non-Forest Service).

Elk Vulnerability and Summer Travel

The Hillis paradigm was used to evaluate the amount of secure elk habitat available in each hunting district. As described by Hillis et al. (1991:40), this method involves calculating the amount of secure habitat in an analysis area, defined as areas >250 acres in size and >0.5 miles from an open road. The use of ATVs for hunting has expanded since the Hillis paradigm was developed. Passenger vehicles and ATVs are commonly used for hunting access where they are allowed, while motorcycles are not. Although data are limited, ATV trails that are open during the hunting season likely have similar impacts on elk vulnerability as do open roads (Canfield et al. 1999:6.16-6.17, Toweill and Thomas 2002:808). Therefore, the analysis method was refined so that security areas were defined to include areas >250 acres in size and >0.5 miles from a road or trail open to passenger vehicles or ATVs. The analysis was unable to discriminate among routes that were open season-long versus those that had seasonal restrictions during the hunting season, and thus it represented a "worst-case" scenario. The percentage of each analysis area meeting the secure habitat criteria described above were calculated and compared among alternatives. Secure habitat values were calculated using all routes, rather than just Forest Service routes.

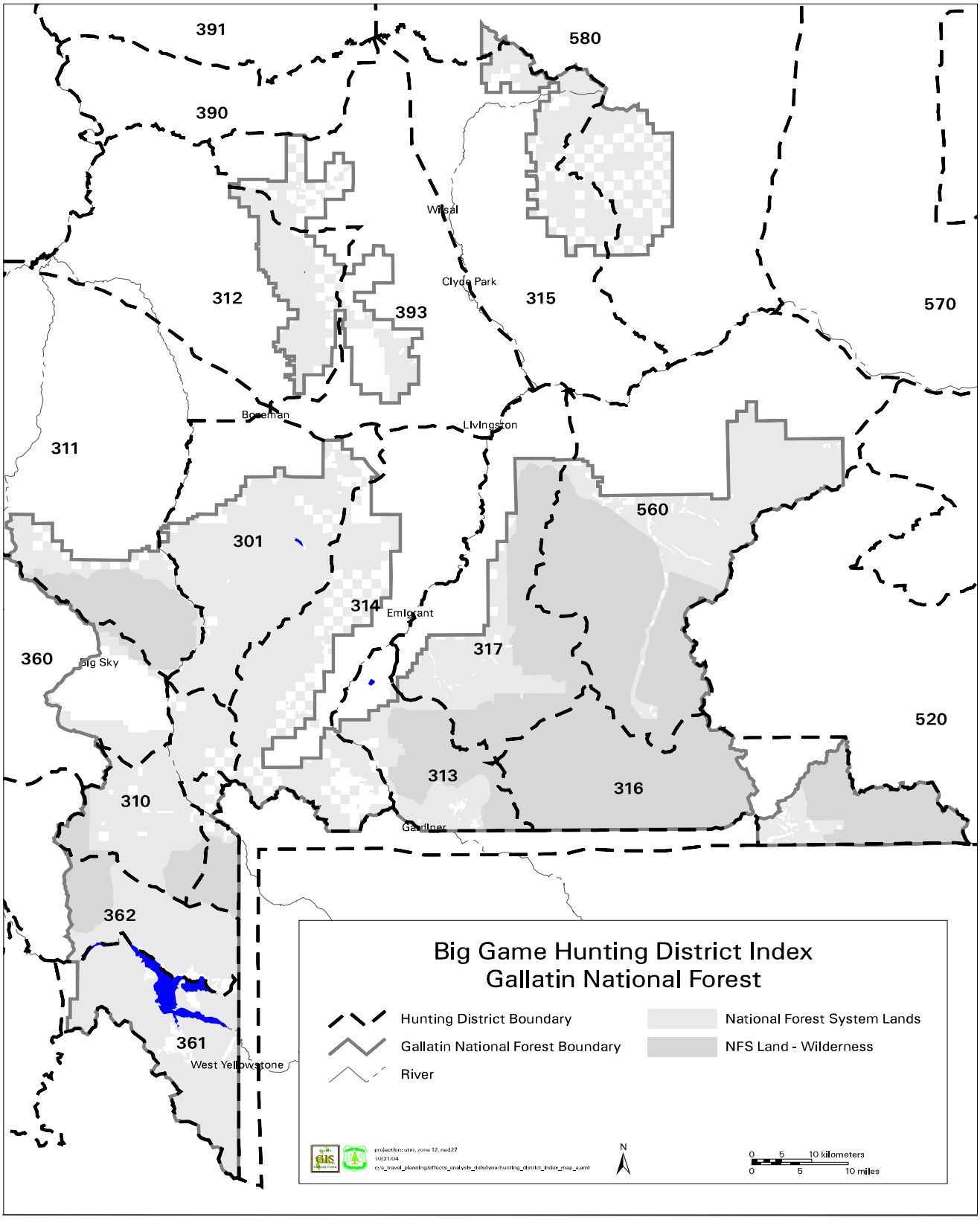
Big Game and Winter Travel

Two important winter travel variables affecting big game animals are the density of designated winter routes within winter range, and the amount of winter range relatively free of human disturbance available to each species. Unlike for elk habitat effectiveness or security, there are no recommended guidelines for winter travel route densities or closure areas within big game winter range.

Two ways of comparing the effects of different winter travel alternatives on big game were used. The first was calculating the density of designated motorized and non-motorized routes within mapped winter range for elk, deer, moose, bighorn sheep, and mountain goats. Winter range data available from the MFWP website were used. This method captures the effects of both motorized and non-motorized uses of groomed or designated routes. It assumes that use of designated non-motorized routes could be heavy enough to affect wintering big game, but that dispersed use would not be.

The second method used was to calculate and compare among alternatives the percentage of elk, moose, bighorn sheep, and mountain goat winter range open to off-trail snowmobiling. This assumes that areas open to off-trail snowmobiling will receive enough use to affect wintering big game. This analysis did not account for areas that are open to snowmobiling but do not receive this amount of use due to low snow cover, inaccessible topography, lack of legal public access or other reasons, and therefore represented a worst-case scenario.

Figure 3.2. 1 Elk and deer hunting districts on the Gallatin National Forest.



Elk Habitat Use/Vulnerability and Summer Travel

Direct and indirect effects of the seven Travel Plan Alternatives on elk summer habitat and vulnerability to hunting were analyzed for each of the 15 hunting districts on the Gallatin National Forest. Districts with open motorized route densities <0.5 mi/sq mi and >70% secure habitat under all alternatives were not discussed. These include Districts 311, 313, 316, 560, and 580. Travel planning would not be an issue for summer elk habitat in these areas because the effects would be so low.

District 301 (Hyalite-Portal)

Effects common to all alternatives

This district would have relatively high open road densities under all alternatives (Table 3.2.3). Most open roads would be Forest Service managed, but there would be some non-Forest Service roads, as well. When all open roads were considered, densities would be 1.0-1.1 mi/sq mi. This corresponds to a habitat effectiveness value of less than 0.7. This is consistent with Christensen et al.'s (1999:2-3) recommendations to manage open road density from 0.7-1.9 mi/sq mi in areas where elk are a primary resource consideration, but do not meet Canfield et al.'s (1999:6.12) recommendations to manage roads at <1.0 mi/sq mi for summer elk habitat.

Alternative 1

This district would have some of the highest open motorized route densities on the Forest (Table 3.2.3). There would be a high concentration of motorized routes in the Gallatin Roaded, Hyalite, and Bear Canyon TPAs. These TPAs have extensive road systems constructed to facilitate past timber harvest, and many of them would be open to motorized use under these alternatives. The Gallatin Crest TPA portion of the district is largely roadless country, but does contain a trail system. Most trails in this area would be open to both motorcycles and ATVs. High open motorized route densities (1.5 mi/sq mi) would lead to considerable disturbance and displacement of elk from summer habitat. Secure elk habitat of 21 % would be well below the recommended 30% minimum from Hillis et al. (1991:40), and bull elk vulnerability to hunting would be high because of high road densities in combination with low percent secure habitat.

Alternative 2 and Existing Condition

Open motorized route density would remain the same as in Alternative 1 (1.5 mi/sq mi), with similar effects to summer elk habitat (Table 3.2.3). Secure habitat would increase, reflecting the fact that not all trails open to ATV use actually receive that use. Secure habitat, of approximately 31 % (Table 3.2.4), would barely be above the minimum recommendation in Hillis et al. (1991:40), but elk vulnerability to hunting would still be relatively high because of high road densities in combination with lower percent secure habitat.

Alternative 3

Open motorized route density (1.5 mi/sq mi) would remain the same (Table 3.2.3) and amount of secure elk habitat (32 %) would increase compared to Alternative 1 (Table 3.2.4). Disturbance and displacement of elk from summer habitat, which was already expected to be high under Alternatives 1 and 2, would increase further. Several trails in the Gallatin Crest TPA would be converted from ATV/motorcycle to motorcycle use, resulting in improved secure elk habitat values. The district

would have slightly more than the 30% secure habitat recommended in the literature, but bull elk vulnerability to hunting would still be relatively high because of high road densities in combination with lower percent secure habitat.

Alternative 4

Open motorized route densities would remain the same as in Alternative 3 (1.5 mi/sq mi) (Table 3.2.3), with similar effects to summer elk habitat, while secure habitat would increase slightly (33 %) (Table 3.2.4). The district would have slightly more than the 30% secure habitat recommended in the literature. Disturbance/displacement of elk from summer habitat and bull elk vulnerability would be highest in the Gallatin Roaded, Hyalite, and Bear Canyon TPA portions of the district where most of the motorized routes would be concentrated.

Alternative 5

Open motorized route densities, of 1.4 mi/sq mi, would be lower than Alternatives 3 and 4 (Table 3.2.3). Secure elk habitat (34 %) would be above the minimum recommended 30% (Table 3.2.4). Open motorized routes would be concentrated in the Gallatin Roaded and Hyalite TPAs. More trails in the Bear Canyon, Gallatin Crest, Bozeman Creek and Gallatin River Canyon TPAs would be managed for non-motorized summer use making this portion of the district more secure and explaining the lower route densities and higher percentage of elk security. Affects elsewhere in the district would be the same as Alternatives 3 and 4.

Alternative 6

This alternative would have the same level of secure elk habitat as Alternative 5 (34%), (Table 3.2.4), although bull elk vulnerability to hunting would still be relatively high. Open motorized route densities would reduce significantly (1.2 mi/sq mi) in the district due to extensive open motorized route systems in the Gallatin Roaded and Hyalite TPAs, but low densities of motorized trails in the Gallatin Crest, Bear Canyon, Bozeman Creek and Gallatin River Canyon TPAs would provide more places with secure elk habitat and lower disturbance/displacement of elk from summer habitat compared to Alternatives 1 and 2 (Table 3.2.3).

Alternative 7-M

Effects of this alternative would be the same as those described under Alternative 4. Open motorized route densities would 1.4 mi/sq mi and secure elk habitat would be 33 % (Tables 3.2.3 and 3.2.4).

District 310 (Upper Gallatin)

Effects common to all alternatives

This district contains some of the most important summer/fall elk habitat in the Madison and Gallatin Ranges due to its diverse landscape and associated vegetation, along with its predominantly roadless character. The district would contain few open roads apart from the main access roads (Highway 191 and the Taylor Fork Road), but would have a well-developed trail system. The habitat effectiveness value would be >0.7. Open road densities would be consistent with recommendations by Canfield et al. (1999:6.12) to manage open road density in summer elk habitat at <1.0 mi/sq mi, and Christensen et al.'s (1993:2-3) recommendation to manage open road density at <0.7 mi/sq mi for areas intended to benefit elk summer habitat and retain high use. Open

motorized route densities would be at lower levels (0.5-0.6 mi/sq mi) under all alternatives (Table 3.2.3). Disturbance and displacement of elk from some areas of important summer habitat would be likely to occur, but there would be adjacent areas of good quality habitat with low human disturbance available to them.

Alternative 1

Almost all trails in both the Taylor Fork and Porcupine-Buffalo Horn TPAs would be managed for motorized use under this alternative. The amount of secure habitat in the district (58 %) would be considerably greater than the recommended minimum of 30%, and bull elk vulnerability to hunting would be moderate (Table 3.2.4). However, bull elk vulnerability to hunting would be greater in the Taylor Fork portion of the district where an extensive trail network would be mostly managed for ATV use. Bull elk vulnerability to hunting would be low in the Porcupine-Buffalo Horn TPA, where there would be no ATV trails or open roads.

Alternative 2 and Existing Condition

Some trails in the Little Wapiti and Meadow Creek areas would be managed for motorcycle rather than ATV/motorcycle use. Secure habitat would increase to 64%, and bull elk vulnerability to hunting would decrease as a result (Table 3.2.4).

Alternatives 3 and 4

Secure habitat (68 %) would increase, due to a change in management of some trails from ATV/motorcycle to motorcycle, and bull elk vulnerability to hunting would be lower because of these changes (Table 3.2.4).

Alternative 5

Secure habitat would increase to 70% in the district, and bull elk vulnerability to hunting would be lower than in Alternatives 1-4 (Table 3.2.4). This is because the ATV trail connection with the Cabin Creek area of District 362 would be eliminated, thus further reducing hunting pressure and the resulting decrease in bull elk vulnerability.

Alternative 6

Secure elk habitat (73 %) would increase due to the elimination of the Oil Well Road Trail #68 as an ATV route, leading to higher secure elk habitat values and thus lower elk vulnerability throughout the district (Table 3.2.4).

Alternative 7-M

There would be slightly less secure habitat (69%) available than under Alternative 5, and bull elk vulnerability would be slightly higher (Table 3.2.4).

District 312 (West Bridger)

Effects common to all alternatives

Open road densities (0.5 mi/sq mi) would be relatively low under all alternatives when only Forest Service roads were considered (Table 3.2.3). However, there are a substantial number of non-Forest Service roads in this district, and open road densities were 1.1 mi/sq mi under all alternatives when all open roads were considered (Table 3.2.3). This corresponds to a habitat effectiveness value of

less than 0.7. This is consistent with Christensen et al.'s (1999:2-3) recommendations to manage open road density from 0.7-1.9 mi/sq mi in areas where elk are a primary resource consideration, but exceeded Canfield et al.'s (1999:6.12) recommendation to manage roads at <1.0 mi/sq mi for summer elk habitat.

Alternative 1

Open motorized route densities (1.5 mi/ sq mi) would be relatively high (Table 3.2.3) partially due to a well-developed trail system managed primarily for ATV/motorcycle use. Disturbance and displacement of elk from some areas of important summer habitat would be moderate. Secure habitat (24%) would be below the minimum recommended 30%, because almost all trails would allow ATV access during the hunting season (Table 3.2.4). Bull elk vulnerability to hunting would therefore be higher.

Alternative 2 and Existing Condition

This alternative would reflect the current condition, with trails in the district managed for motorcycle rather than ATV use. A portion of the road system in the Fairy Lake TPA would be managed for ATV use. Open motorized route densities (1.6 mi/sq mi) increase from Alternative 1, with similar effects to summer elk habitat (Table 3.2.3). However, there would be a large increase in secure elk habitat compared to Alternative 1, resulting from the shift in trail management from ATV to motorcycle. Elk secure habitat would increase to 49%, and bull elk vulnerability to hunting would decrease to more moderate levels (Table 3.2.4).

Alternative 3

This alternative would have high open motorized route densities (1.5 mi/sq mi), due to the addition of motorcycle trails in the West Bridger North TPA, and additional ATV and motorcycle trails in the Fairy Lake TPA (Table 3.2.3). Although, secure habitat would increase to 51% under this alternative and therefore elk vulnerability would be more moderate (Table 3.2.4).

Alternative 4

There would be a large drop in open motorized route density (1.3 mi/sq mi) under this alternative, because most trails would be managed for non-motorized rather than motorcycle use (Table 3.2.3). There would be a corresponding decrease in the potential for disturbance and displacement of elk from summer habitat. Secure habitat values (51%), and resulting potential for bull elk mortality to hunting, would be the same as under Alternative 3 (Table 3.2.4).

Alternatives 5 and 6

Open motorized route densities (1.1 mi/sq mi) would decrease from all previous alternatives (Table 3.2.3). All trails in the West Bridger North and West Bridger South TPAs would be managed for non-motorized use, and most motorized use would be in the Fairy Lake TPA. Because a large portion of the district would be managed for non-motorized use, the potential for disturbance and displacement of elk from summer habitat would be lower under this alternative. Additionally, more secure habitat (52%) would be available so bull elk vulnerability to hunting would be lower than for all previous alternatives (Table 3.2.4).

Alternative 7-M

The effects of this Alternative would the same as those described under Alternative 4. Open motorized route density would increase to 1.4 mi/sq mi and secure elk habitat (51%) would be the same as Alternative 4 (Tables 3.2.3 and 3.2.4).

District 314 (Upper Yellowstone West)

Effects common to all alternatives

Open road densities are considerably higher when all open roads are considered compared to when just Forest Service roads are considered, because there are a substantial number of non-Forest Service roads in this district. The habitat effectiveness value would be <0.7. This is consistent with Christensen et al.'s (1999:2-3) recommendations to manage open road density from 0.7-1.9 mi/sq mi in areas where elk are a primary resource consideration, but exceeded Canfield et al.'s (1999:6.12) recommendation to manage roads at <1.0 mi/sq mi in summer elk habitat.

Alternative 1

Open motorized route densities (1.3 mi/sq mi) would be moderate when all routes are considered (Table 3.2.3). Secure elk habitat values (36 %) would be slightly above the recommended 30% minimum from the literature, and bull elk vulnerability to hunting could be relatively high because of this (Table 3.2.4). However, legal public access to National Forest land is limited in this area (T. Lemke, MFWP, personal communication) and would partially compensate for the lower percentage of secure habitat.

Alternative 2 and Existing Condition

This alternative would reflect the current condition, where most trails in the district would be managed for motorcycle rather than ATV use. The amount of secure habitat would increase to 51% and open motorized route density (1.3 mi/sq mi) would be unchanged from Alternative 1 (Tables 3.2.3 and 3.2.4). There would be much less ATV or passenger/high clearance vehicle access during the hunting season, explaining the increase in secure habitat, and thus bull elk vulnerability to hunting would decrease.

Alternatives 3 through 7-M

ATV or passenger/high clearance vehicle access during the hunting season would decrease from Alternative 2. Open route densities would range from 1.0 to 1.2 mi/sq mi and secure habitat would increase to 54%. This would result in lower bull elk vulnerability to hunting (Tables 3.2.3 and 3.2.4).

District 315 (West Slope Crazy Mountains)

Effects common to all alternatives

This district contains a substantial number of non-Forest Service roads as well as a network of Forest Service roads. Open road densities would be 1.0 mi/sq mi under all alternatives when all open roads were considered, for a habitat effectiveness value of <0.7. This is consistent with Christensen et al.'s (1999:2-3) recommendations to manage open road density from 0.7-1.9 mi/sq

mi in areas where elk are a primary resource consideration, but exceeded Canfield et al.'s (1999:6.12) recommendation to manage roads at <1.0 mi/sq mi for summer elk habitat.

Alternative 1

Open motorized route densities (1.4 mi/sq mi) and resulting disturbance and displacement of elk from some areas of important summer habitat would be relatively high, due to the combination of an open road and ATV trail system in the Shields TPA along with an ATV trail system in the Ibex TPA (Table 3.2.3). Secure habitat for elk (25%) during the hunting season would be below the minimum recommended 30% level (Hillis et al. 1991:40) and thus bull elk vulnerability could be high (Table 3.2.4). However, low elk secure habitat would be partially compensated for by limited legal public access to National Forest land in this district (T. Lemke, MFWP, personal communication).

Alternative 2 and Existing Condition

Open motorized route densities (1.4 mi/sq mi) and effects to summer elk habitat would be the same as in Alternative 1 (Table 3.2.3). Due to a shift in management on some trails in the Ibex and Shields TPAs from ATV to motorcycle use, there would be an increase in secure elk habitat (31%) (Table 3.2.4). Although secure habitat would be barely above the recommended 30% minimum, bull elk vulnerability to hunting would remain high because of road densities in combination with secure habitat.

Alternative 3

Open motorized route densities (1.7 mi/sq mi) would be considerably higher under this alternative than for all other alternatives, due to the addition of both ATV and motorcycle routes throughout the district (Table 3.2.3). Disturbance and displacement of elk from summer habitat would be relatively high. Secure habitat would increase to 34%, but bull elk vulnerability to hunting could still be relatively high (Table 3.2.4).

Alternative 4

Motorized access would be more concentrated in the Shields TPA under this alternative, while there would be fewer motorized access routes in the East Crazies TPA portion of the district. Therefore, while open motorized route densities (1.4 mi/sq mi) would the same as under Alternative 1, there would be places in the district with little motorized access where disturbance and displacement of elk would be low (Table 3.2.3). There would be an increase in secure habitat to 37%, but bull elk vulnerability to hunting could still be high (Table 3.2.4). While the Shields TPA portion of the district would have high ATV or passenger/high clearance vehicle access during the hunting season, the East Crazies portion of the district would provide a large block of secure habitat.

Alternative 5

Open motorized route densities (1.3 mi/sq mi) would continue to decrease, and most motorized access would be in the Shields TPA (Table 3.2.3). The entire East Crazies portion of the district and a large part of the Ibex TPA would be managed for non-motorized use, providing a large area of summer habitat for elk where disturbance and displacement would be low. The district would contain the same amount of secure habitat (37%) during the hunting season as in Alternative 4, primarily in the East Crazies and Ibex TPAs (Table 3.2.4).

Alternative 6

Open motorized route density would remain high (1.1 mi/sq mi) in the Shields TPA, but the East Crazies TPA portion of the district and the entire Ibex TPA would be managed for non-motorized use (Table 3.2.3). Therefore, disturbance and displacement of elk from summer habitat would be high in the Shields TPA, but low everywhere else in the district. Bull elk vulnerability to hunting would be a similar situation, with overall moderate levels of secure habitat (38%) located mostly outside the Shields TPA (Table 3.2.4).

Alternative 7-M

Open motorized route densities would be the same as those under Alternative 4 and secure habitat (35%) would be slightly lower (Table 3.2.4). However, motorized use would be more concentrated in the Shield TPA compared to the East Crazies TPA portion of the district.

District 317 (Upper Yellowstone East)

Effects common to all alternatives

Most of this district would be within the Absaroka Beartooth (AB) Wilderness or roadless country managed for non-motorized use. Open road densities (0.3-0.4 mi/sq mi) would be low across all alternatives, with habitat effectiveness values >0.7 mi/sq mi. Disturbance/displacement of elk from summer habitat and bull elk vulnerability to hunting would not be an issue in most of the district due to the very limited amount of motorized access (Table 3.2.3). The percentage of secure elk habitat would range from 76-78% for all alternatives (Table 3.2.4). The exception is the Mill Creek TPA portion of the district, which is the only area in District 317 with a developed road system and significant motorized access. Open motorized routes would be high enough in all alternatives to cause disturbance and displacement of elk from summer habitat in the Mill Creek area, but there would normally be adjacent areas of good quality habitat with low human disturbance available to them. Bull elk vulnerability to hunting would also be high in this portion of the district. However, the surrounding landscape would largely have no motorized access under all alternatives, and overall elk vulnerability to hunting would be low.

District 360 (North Madison)

Effects common to all alternatives

This district contains a large amount of private land around the town of Big Sky within the Gallatin National Forest boundary. There is an extensive open road system, but very few of these are Forest Service roads. Recommendations for managing open road density in summer elk habitat (Christensen et al. 1993:2-3; Canfield et al. 1999:6.12) would be exceeded under all alternatives, with >2.0 mi/sq mi of open roads. Additionally, motorized route densities would be high (2.3-2.5 mi/sq mi) and secure habitat low (25-34%) under all alternatives (Table 3.2.3 and 3.2.4). Thus displacement and disturbance of elk from important summer habitat and bull elk vulnerability to hunting would both be high. However, management of summer travel on Forest Service routes would have relatively little effect on this situation, because most of the motorized access in this district is outside of Forest Service jurisdiction.

District 361 (Hebgen-Upper Madison)

Effects common to all alternatives

This district has an extensive road system in the Hebgen Lake Basin and South Plateau TPAs, along with portions of the Lionhead TPA. The other portion of the district within the Lionhead TPA is largely roadless area. Most roads within this district are Forest Service roads, and open road densities range from 1.3-1.4 mi/sq mi under all alternatives for a habitat effectiveness value of <0.7 (Table 3.2.3). This is consistent with Christensen et al.'s (1999:2-3) recommendations to manage open road density from 0.7-1.9 mi/sq mi in areas where elk are a primary resource consideration, but exceeds Canfield et al.'s (1999:6.12) recommendation to manage roads at <1.0 mi/sq mi for summer elk habitat. This value was calculated considering the entire district, including the roadless portion of the Lionhead TPA. Therefore, open road densities in the rest of the Lionhead TPA, along with the South Plateau and Hebgen Lake Basin TPAs, would actually be considerably higher than 1.3 mi/sq mi.

Alternative 1

Open motorized route densities would be approximately 1.4 mi/sq mi, and disturbance and displacement of elk from summer habitat would be relatively high (Table 3.2.3). Secure habitat values (20%) would be the lowest of all districts on the Forest, with most of the secure habitat found in the roadless portion of the Lionhead TPA (Table 3.2.4). Because of high motorized route densities and low levels of secure habitat bull elk vulnerability to hunting would be high. ATV trails in Watkins Creek and Sheep Creek would limit the availability of secure habitat even in the roadless portion of the Lionhead TPA.

Alternative 2 and Existing Condition

Open motorized route densities (1.4 mi/sq mi) would remain the same as Alternative 1, with similar effects to summer elk habitat (Table 3.2.3). This alternative reflects the fact that ATVs do not currently use some of the trails in the roadless portion of the Lionhead TPA. As a result, there would be a small increase in secure habitat to 23%, but bull elk vulnerability to hunting would remain high (Table 3.2.4).

Alternatives 3 and 4

There would be no increase in motorized route density (1.4 mi/sq mi) compared to Alternative 1, even though there would be an increase in routes open to ATV travel in the South Plateau TPA and the roaded portion of the Lionhead TPA (Table 3.2.3). Secure elk habitat (22%) would be slightly higher than Alternative 1, but would still be below recommended levels (Table 3.2.4). This would result in an increased amount of disturbance and displacement of elk from summer habitat in an area already subject to high amounts of motorized access. These increases in ATV access would have little impact on bull elk vulnerability to hunting, because they would occur in areas with other ATV or passenger/high clearance vehicle access during the hunting season and outside of secure habitat. Management of summer travel in the roadless portion of the Lionhead TPA would remain the same as in Alternative 2, with the same effects on summer elk habitat and bull elk vulnerability to hunting.

Alternative 5

Open motorized route densities (1.3 mi/sq mi) would decrease slightly under this alternative (Table 3.2.3). However, this small decrease in open motorized route density could have a large beneficial impact on summer elk habitat because it would remove all motorized access from the Watkins Creek drainage west to the Forest boundary. High open motorized route densities in the district would be partially mitigated by management of a large area of high quality habitat for non-motorized use with low disturbance and displacement of elk. The situation would be similar for bull elk vulnerability, where low amounts of secure habitat (24%) in the district would be somewhat compensated for by management of the roadless area to provide a large block of secure habitat (Table 3.2.4).

Alternative 6

Open motorized route densities (1.3 mi/sq mi) and resulting impacts to summer elk habitat would be similar to those under Alternative 5 (Table 3.2.3). Secure habitat (26%) would still be below the recommended 30% minimum level (Table 3.2.4). However, there would be additional secure habitat created in the South Plateau TPA by shifting management of ATV trails around Two Top and the Continental Divide to non-motorized use. This would further mitigate the effects of low secure habitat in the area by providing an additional block of secure habitat beyond that available in Alternative 5.

Alternative 7-M

Under this preferred alternative, open motorized route densities (1.3 mi/sq mi) and their resulting impacts would be similar to those described under Alternative 4 (Table 3.2.3). Secure elk habitat (24%) would be similar to Alternative 5 (Table 3.2.4).

District 362 (South Madison)

Effects common to all alternatives

Most of this district is designated Wilderness or roadless and provides important summer/fall habitat for elk in the southern Madison Range. The open roads within this district are mostly Forest Service roads, and open road densities range from 0.3-0.6 mi/sq mi under all alternatives (Table 3.2.3). This equates to a high habitat effectiveness value of >0.7. Open motorized route densities are low enough under all alternatives, so that disturbance and displacement of elk from summer habitat by motorized use would occur, but at a relatively low level. There would normally be adjacent areas of high quality habitat available to elk displaced by summer motorized use.

Alternative 1

Although the district would have well above the recommended minimum 30% secure habitat (58%), part of the secure habitat would be in the Lee Metcalf (LM) Wilderness Hilgard TPA (Table 3.2.4). Much of this TPA consists of steep, heavily-forested slopes and high rocky peaks, and is of less value to elk than the Cabin Creek TPA. The trail system in the Cabin Creek TPA, which provides some of the best summer/fall elk habitat in the Madison Range due to its ideal mix of forest and meadow vegetation with interspersed springs and creeks, would be managed for ATV/motorcycle use under this alternative. As a result, bull elk vulnerability to hunting would be moderate.

Alternative 2 and Existing Condition

This alternative would reflect the current condition, with most trails in the district outside of the LM Wilderness Hilgard TPA managed for motorcycle rather than ATV use. The amount of secure elk habitat would increase to 66%, and bull elk vulnerability to hunting would still be moderate (Table 3.2.4). However, Trails 151 and 206 would be managed to provide ATV access through nearly the entire length of the Cabin Creek TPA and would connect to the Taylor Fork TPA. This would facilitate hunting pressure in some of the best elk habitat within the district.

Alternatives 3 and 4

There would be a 4% increase in secure habitat to 70% in the district (Table 3.2.4). However, Trails 151 and 206 would still provide ATV access through the middle of the Cabin Creek TPA during the hunting season. Therefore, bull elk vulnerability to hunting would be similar to Alternative 2.

Alternatives 5 through 7-M

The ATV route through the Cabin Creek TPA connecting to the Taylor Fork TPA would be eliminated under these alternatives. Secure habitat values in the district would increase to 76-77%, and therefore bull elk vulnerability to hunting would be low (Table 3.2.4).

District 393 (East Bridger)

Effects common to all alternatives

This district contains a road and trail system in both the North Bridger and Bangtails TPAs. There are a large number of non-Forest Service roads in this district, and open road densities range from 2.2-2.4 mi/sq mi for all alternatives (Table 3.2.3). Recommendations for managing open road density in summer elk habitat (Christensen et al. 1993:2-3, Canfield et al. 1999:6.12) are exceeded under all alternatives. However, Forest Service management of summer travel would have relatively little effect on high open road densities regardless of the alternative, because those routes make up a relatively small percentage of the total open roads in the district.

Alternative 1

Under this alternative, open motorized route densities (2.3 mi/sq mi) would be the highest of any district on the Forest, and high disturbance and displacement of elk from areas of important summer habitat would be expected (Table 3.2.3). Secure habitat (7%) would extremely low, and therefore bull elk vulnerability to hunting would be highest of any district on the Forest (Table 3.2.4).

Alternative 2 and Existing Condition

Open motorized route densities (2.3 mi/sq mi) would remain the same as in Alternative 1, with similar effects to summer elk habitat (Table 3.2.3). There would be a small increase in secure habitat (11%) reflecting the fact that ATVs do not currently use some trails in the North Bridger TPA (Table 3.2.4). These factors would result in a small decrease in bull elk vulnerability compared to Alternative 1.

Alternative 3

There would be an increase in open motorized route density (2.4 mi/sq mi) compared to the previous alternatives (Table 3.2.3). Most of this increase would come from additional motorized

trails in the Bangtails TPA, while one trail in the Bridger North TPA would be shifted to non-motorized use. The potential for disturbance and displacement of elk from important summer habitat would increase in the Bangtails TPA. There would be a small net increase in secure habitat (12%), mostly due to decreases in ATV routes in the North Bridger TPA (Table 3.2.4). Therefore, bull elk vulnerability to hunting would remain high.

Alternatives 4 through 7-M

The effects of these alternatives would be the same as those described under Alternative 2 and 3.

Effects of Seasonal Restrictions

Seasonal restrictions on various types of travel including summer motorize use were incorporated into the alternatives (see Chapter 2 for detailed descriptions). These restrictions were not considered in the quantitative analysis of the effects of summer motorized travel on big game habitat. However, some seasonal restrictions would lessen the effects of summer motorized use on big game where they were applied. For example, some motorized routes would be closed to motorized use from May 15-June/July 15. In these places, there would be lower disturbance to elk or other big game animals during the important calving/fawning period. Restrictions were also placed on some motorized routes during the fall, which would improve secure habitat for elk by decreasing motorized access during the hunting season.

Winter Travel and Big Game

Direct and indirect effects of the seven Travel Plan alternatives on elk, moose, bighorn sheep, and mountain goat winter range were analyzed for each of the 15 hunting districts on the Gallatin National Forest. District 316 (AB Wilderness, AB Boulder Plateau, and Cooke City TPAs) has no designated winter travel routes or areas open to snowmobile use within winter range for elk, moose, bighorn sheep, or mountain goats and is therefore not discussed.

District 301 (Hyalite-Portal)

Effects common to all alternatives

This district contains a large amount of winter range for elk (76.9 mile^2), moose (33.7 mile^2), and bighorn sheep (18.2 mile^2) in the Gallatin Range (Table 3.2.5). There is no mountain goat winter range, so effects of winter travel are not an issue for this species.

Alternatives 1 and 2

Relative to most other areas on the Forest, there would be a high density of designated winter travel routes in elk (0.6 mi/sq mi) (mostly in the Gallatin Roaded TPA) and bighorn sheep (0.3 mi/sq mi) winter range (Table 3.2.6). Additionally, the winter range for these species would be almost entirely open to unrestricted snowmobile use. Disturbance and displacement of elk and sheep on winter range could be high under these alternatives. Effects to moose would be lower, because there would be a lower density (0.2 mi/sq mi) of designated winter travel routes within moose winter range. Although, the percentage (8%) of moose winter range and elk winter range (3%) closed to snowmobile use off designated routes would be low (Table 3.2.7).

Alternative 3

This alternative would have the greatest effect on elk winter range, because the density (0.7 mi/sq mi) of designated winter travel routes would increase, and the percentage of elk winter range (9%) closed to snowmobile use off designated routes would remain low (Tables 3.2.6 and 3.2.7). There would be an increase in the percentage of moose (27%) and sheep (13%) winter range closed to snowmobile use off designated routes, so effects to these species would be reduced (Table 3.2.7).

Alternative 4

The effects of this alternative on elk and moose winter range would be similar to those described for Alternative 3. There would be an increase in the percentage (34 %) of bighorn sheep winter range closed to snowmobile use off designated routes, and effects to this species would therefore be reduced (Table 3.2.7).

Alternative 5

The density (0.6 mi/sq mi) of designated winter travel routes in elk winter range would be the same as in Alternatives 1 and 2, but the percentage (10%) of elk winter range closed to snowmobile use would be higher (Tables 3.2.6 and 3.2.7). Effects to wintering elk would therefore be lower. Effects to moose and sheep winter range would be the same as was described for Alternative 4.

Alternatives 6 and 7-M

The effects of these alternatives on elk, moose, and sheep winter range would be the same as described in Alternative 4.

District 310 (Upper Gallatin)

Effects common to all alternatives

There is very little bighorn sheep winter range in this district (0.1 mile^2) within the Taylor Fork and Porcupine-Buffalo Horn TPAs, and the winter range that does exist would have no designated winter travel routes and would be mostly closed to snowmobile use (Table 3.2.5). The district contains a substantial amount of mountain goat winter range (14.6 mile^2), but the goat winter range would have no designated travel routes and would be almost entirely closed to snowmobiling (Table 3.2.5). Therefore, effects of winter travel to these species would be very low among all alternatives for this district.

Alternatives 1 and 2

This district has a large amount of important elk (102.1 mile^2) and moose (81.1 mile^2) winter range (Table 3.2.5). The density (0.2 mi/sq mi) of designated winter travel routes would be relatively low within winter range for both species (Table 3.2.6). Approximately 42% of the elk winter range and 47% of moose winter range would be closed to snowmobile use off designated routes (Table 3.2.7). As a result, there would be a substantial area of elk and moose winter range open to snowmobile use. Part of this area receives heavy snowmobile use, especially around the Wapiti trailhead. Disturbance and displacement of both species would occur, but the effects on moose would be greater than for elk. This is because the most important elk winter range in the Meadow Creek area would be closed to all snowmobile use, while more of the best quality moose winter range (such as in the Wapiti and Little Wapiti drainages) would be open to unrestricted snowmobile use.

Alternative 3

Effects of winter travel on moose and elk winter habitat would be greater than any alternative because of an increase in the density of designated winter travel routes in elk (0.3 mi/sq mi) and moose (0.4 mi/sq mi) winter ranges (Table 3.2.6). This is due to the addition of a designated snowmobile route through important winter range in the Deadhorse and Buck Creek drainages.

Alternatives 4 and 5

The effects of these alternatives would be similar to those of Alternatives 1 and 2. Density of winter travel routes (0.2 mi/sq mi) would be the same, and there would be only a small increase (<=1%) in the area closed to snowmobile use off designated routes (Tables 3.2.6 and 3.2.7).

Alternative 6

Effects of winter travel on elk and moose winter range would be lowest of all alternatives. There would be a decrease in the density (0.1 mi/sq mi) of designated winter travel routes, along with a large increase in the percentage of elk (82%) and moose (87%) winter range closed to snowmobile use off designated routes (Tables 3.2.6 and 3.2.7).

Alternative 7-M

This alternative would have less effect on elk and moose winter range than Alternatives 1 and 2. The density (0.2 mi/sq mi) of designated winter travel routes would be the same, but the groomed snowmobile trailhead would be moved out of the Wapiti Creek area (which is important moose winter range) to the Sage Creek parking area (Table 3.2.6). The trail would go around the some of the most important moose winter range in this portion of the district. Additionally, there would be approximately 20% more elk (62%) and moose (66%) winter range closed to snowmobile use off designated routes (Table 3.2.7).

District 311 (Lower Gallatin)

Effects common to all alternatives

This district contains moderate amounts of elk (35.4 mile^2) and moose (8.5 mile^2) winter range, and some of the most important bighorn sheep (18.9 mile^2) winter range on the Forest (Table 3.2.5). It also contains the largest area (61.0 mile^2) of goat winter range on the Forest (Table 3.2.5). There would be no designated winter travel routes in mountain goat winter range, and mountain goat winter range would be almost entirely closed to snowmobile use in all alternatives. Therefore, effects of winter travel on mountain goats in this district within the LM Wilderness Spanish Peaks, Cherry Creek, and Gallatin River Canyon TPAs negligible.

Alternatives 1 and 2

These alternatives would have designated ski/snowshoe trails at relatively low densities in elk (0.1 mi/sq mi), moose (0.2 mi/sq mi), and sheep (0.2 mi/sq mi) winter range (Table 3.2.6). Most moose winter range (84%) would be open to snowmobile use, while 59% of elk winter range and almost (75%) all bighorn sheep winter range would be closed to snowmobile use (Table 3.2.7). Non-motorized winter travel would have greater effects on wintering big game in this district compared to snowmobiles. This is because most of the district receives little snowmobile use in most areas that are open; due to low snow cover, a lack of designated or groomed routes, and because they would be constrained by surrounding designated wilderness where snowmobile use would not be

allowed. A designated ski/snowshoe route in the Cherry Creek TPA would facilitate these non-motorized uses.

Alternatives 3 through 7-M

There would be no increase in designated winter travel route densities in winter range for elk, moose, and sheep under these alternatives (Table 3.2.6). There would be an increase in area of winter range for elk (86%), moose (73%) and Bighorn sheep (98%) that was closed to snowmobile use, but the actual effects to wintering big game would not be much different from Alternatives 1 and 2, because most of the additional snowmobile closure would be in areas that are not conducive to snowmobile use (Table 3.2.7).

District 312 (West Bridger)

Effects common to all alternatives

Bighorn sheep are not found in the Bridger Range, so there would be no issue with winter travel for this species in District 312. Elk winter range is so limited (1.6 mile^2), so there would be few effects on elk from winter travel under any alternative (Table 3.2.5).

Alternatives 1 and 2

This district contains relatively extensive winter range for moose (19.4 mile^2) and mountain goats (16.5 mile^2) (Table 3.2.5). There would be a high density of designated winter travel routes (both snowmobile and ski/snowshoe) within moose winter range (0.7 mi/sq mi), but none in mountain goat winter range (Table 3.2.6). In addition, almost all moose and mountain goat winter range would be open to unrestricted snowmobile use in an area that is feasible for this type of use (Table 3.2.7). There would be high potential for disturbance and displacement of moose and mountain goats from important winter range as a result.

Alternatives 3 and 4

These alternatives would have greater effects on moose winter range than all others in this district. The density of designated winter travel routes in moose winter range (0.9 mi/sq mi) would increase to the highest of all alternatives (Table 3.2.6). There would still be no designated winter travel routes in goat winter range (Table 3.2.6). There would be an increase in area of both moose (13%) and goat (20%) winter range closed to snowmobile use off designated routes compared to Alternatives 1 and 2, but most winter range for these species would still be open to unrestricted snowmobile use (Table 3.2.7).

Alternative 5

This alternative would have the fewest effects on moose and mountain goat winter range. The density of designated winter travel routes in moose winter range (0.8 mi/sq mi) would be similar to that of Alternatives 1 and 2, but there would be a small increase in area of moose winter range (14%) closed to snowmobile use off designated routes (Tables 3.2.6 and 3.2.7). Mountain goat winter range (98%) would be almost entirely closed to snowmobile use under this alternative (Table 3.2.7).

Alternative 6 and 7-M

The effects of these alternatives on moose winter range would be similar to those described for Alternative 5. The effects of this alternative on goat winter range would be the same as those described under Alternatives 3 and 4, except the percentage of goat winter range closed to snowmobile use off designated routes would increase to 37% in Alternative 7-M (Table 3.2.7).

District 313 (Gardiner)

Effects common to all alternatives

This district contains no mountain goat winter range, and winter travel is therefore not an issue for this species. The district does contain important elk (58.7 mile^2) and bighorn sheep (9.5 mile^2) winter range, and some moose winter range (7.2 mile^2) (Table 3.2.5). Winter travel would have very few effects under all alternatives. This is because there would be no designated winter travel routes within elk or sheep winter range, most of the elk and sheep winter range would be closed to snowmobiling, and areas remaining open to snowmobile use would receive little use due to low snow cover.

Alternatives 1 and 2

Non-motorized winter travel would have greater effects on moose winter range than snowmobile use in this district. There would be a relatively high density (0.4 mi/sq mi) of designated ski/snowshoe routes in moose winter range in the Bear Creek area (Table 3.2.6). Only 30% of moose winter range in this district would be closed to snowmobile use, but snowmobile access is poor in this area and the current light levels of snowmobile use would be expected to continue (Table 3.2.7).

Alternatives 3 through 7-M

These alternatives would have the greatest effects on moose winter range, because there would be an increase in density (0.6 mi/sq mi) of designated ski/snowshoe routes compared to Alternatives 1 and 2 (Table 3.2.6).

District 314 (Upper Yellowstone West)

Effects common to all alternatives

This district contains no mountain goat winter range, and winter travel is therefore not an issue for this species. There are no designated winter travel routes within elk winter range, and most elk winter range is outside of areas accessible to snowmobiles due to low snow cover and a lack of legal public access. Therefore, effects of winter travel on elk winter range would be low under all alternatives.

Alternatives 1 and 2

This district contains important moose winter range (31.3 mile^2) and the more bighorn sheep winter range (19.5 mile^2) than any other district on the Forest (Table 3.2.5). There would be a relatively low density of designated winter travel routes in moose winter range (0.2 mi/sq mi), and none in bighorn sheep winter range (Table 3.2.6). Only 3% of moose winter range and 16% of bighorn sheep winter range would be closed to snowmobile use (Table 3.2.7). Most of the area open to

snowmobile use within winter range for these species is not accessible to snowmobiles (particularly for bighorn sheep) due to low snow cover and a lack of legal public access, so effects of snowmobile use would be minimized.

Alternative 3

There would be a substantial increase in area of moose (55%) and bighorn sheep (54%) winter range closed to snowmobiling, but most of this increase would be in areas that have poor snowmobile access due to low snow cover and a lack of legal public access (Table 3.2.7). Therefore, the actual effects would be to the same as Alternatives 1 and 2.

Alternative 4

Under this alternative, the amount of area closed to snowmobile use off designated routes would increase to 73% for bighorn sheep and 55% for moose (Table 3.2.7). This increase would result in fewer effects to moose winter range, as some of the increase in snowmobile restrictions would be in the Porcupine Buffalo Horn and Tom Miner Rock TPAs that would otherwise be accessible to snowmobiles.

Alternative 5

Effects of this alternative on bighorn sheep winter range would be similar to those described under Alternative 4. However, this alternative would have the most area of moose winter range closed to snowmobile use off designated routes (69%) (Table 3.2.7).

Alternatives 6 and 7-M

Effects of these alternatives would be the same as those described under Alternative 4.

District 315 (West Slope Crazy Mountains)

Effects common to all alternatives

There is no elk winter range within District 315, and bighorn sheep are not present in the Crazy Mountains. Therefore, winter travel is not an issue for these species. Additionally, there would be no designated winter travel routes within winter range for moose or mountain goats under any alternative.

Alternatives 1-4

The district contains much of the winter range for moose (17.7 mile^2) in the Crazy Mountains, along with a relatively small amount of mountain goat winter range (3.4 mile^2) (Table 3.2.7). Almost of all this area would be open to snowmobile use under these alternatives, and some disturbance and displacement of wintering moose and goats would be expected. However, these effects would be somewhat lessened by the fact that there would not be a system of designated or groomed trails to facilitate snowmobile use.

Alternative 5

The amount of area closed to snowmobile use off designated routes would increase to 25% in moose winter range and 83% in mountain goat winter range (Table 3.2.7). Effects on wintering moose and goats would therefore be lower than those expected under Alternatives 1-4.

Alternative 6

The effects of this alternative on moose and goat winter range would be the same as those under Alternatives 1-4.

Alternative 7-M

The effects of this alternative on moose winter range would be the same as Alternative 5. The percentage of goat winter range closed to snowmobile use (54%) would be much greater than Alternatives 1-4 (0-6%), but less than Alternative 5 (83%) (Table 3.2.7).

District 317 (Upper Yellowstone East)

Effects common to all alternatives

There is no winter range for mountain goats or bighorn sheep within this district, and winter travel is therefore not an issue for these species. There is a considerable amount of elk winter range (23.2 $mile^2$) in the district, but there are no designated winter travel routes, and the area is not conducive to snowmobile use due to low snow cover and limited legal public access (Table 3.2.5). Therefore, effects to elk winter range from winter travel would be low for all alternatives.

Alternative 1

There is a relatively large amount of winter range for moose in this district (39.8 $mile^2$) (Table 3.2.5). There would be approximately 0.3 mi/sq mi of designated ski/snowshoe and snowmobile routes within moose winter range in the Mill Creek TPA under this alternative (Table 3.2.6). Approximately 44% of the moose winter range would be closed to snowmobile use off designated routes (Table 3.2.7). Therefore, impacts to moose winter range would be moderate under this alternative.

Alternative 2 and Existing Condition

This alternative would have slightly fewer effects on moose winter range than Alternative 1. The same system of designated winter travel routes would exist (0.2 mi/sq mi), but the area of moose winter range closed to snowmobile use would increase to 56% (Table 3.2.6 and 3.2.7).

Alternatives 3 and 4

These alternatives would have greater effects on moose winter range than Alternative 1, because the density of designated winter travel routes would increase to 0.4 mi/sq mi (Table 3.2.6). The amount of area closed to snowmobile use off designated routes (56%) would remain the same as in Alternative 2 (Table 3.2.7).

Alternatives 5 and 6

The effects of these alternatives would be the same as those described under Alternative 2.

Alternative 7-M

This alternative would have both the highest density of designated winter travel routes (0.5 mi/sq mi) and the greatest area closed to snowmobile use off designated routes (69%) in moose winter range (Table 3.2.6 and 3.2.7). Effects to moose could be greater under this alternative than any

other, because the increase in designated winter travel routes could offset the benefits of closing additional areas to snowmobile use off designated routes.

District 360 (North Madison)

Effects common to all alternatives

This district contains a moderate amount of winter range for elk (23.2 mile^2), moose (12.0 mile^2), and bighorn sheep (2.0 mile^2), along with relatively extensive mountain goat winter range (15.8 mile^2) (Table 3.2.5). Portions of this district in the Big Sky TPA would be expected to continue to receive heavy snowmobile and ski/snowshoe use on and around designated routes where those uses are legal. Under all alternatives, there would be a moderate density of designated snowmobile routes in elk (0.3 mi/sq mi) and moose (0.5 mi/sq mi) winter range (Table 3.2.6) along with a low percentage of winter range (4-10%) area closed to snowmobile use off designated routes (Table 3.2.7). The potential for disturbance and displacement of wintering moose and elk would be relatively high under all alternatives as a result.

Alternatives 1 and 2

Under these alternatives, there would be approximately 0.3 mi/sq mi of designated ski/snowshoe routes within mountain goat winter range (Table 3.2.6). Approximately 57% of mountain goat winter range would be closed to snowmobile use off designated routes (Table 3.2.7). Disturbance and displacement of wintering mountain goats could be relatively high under these alternatives. There would be no designated winter travel routes within bighorn sheep winter range, but all of it would be open to unrestricted snowmobile use. However, the bighorn sheep winter range in this district is not conducive to snowmobile use due to low snow cover and because of the constraint of the surrounding designated Wilderness where snowmobile use is not allowed.

Alternatives 3 though 7-M

The density of designated routes with mountain goat winter range would be the same as under Alternatives 1 and 2. There would be a large increase in area of winter range for both goats (86%) and bighorn sheep (49%) closed to snowmobile use off designated routes under these alternatives (Table 3.2.7). However, the actual benefits of this increase for these species would be limited because most of the winter range in this district is not conducive to snowmobile use.

District 361 (Hebgen-Upper Madison)

Effects common to all alternatives

This district contains only a small amount of mountain goat winter range (0.2 mile^2) (Table 3.2.5). It is located in an area with no designated routes under any alternative and where snowmobile access is poor due to extremely steep terrain and because of the constraint of the surrounding designated Wilderness where snowmobile use is not allowed. Therefore, effects of all alternatives on mountain goat winter range would be limited for all alternatives.

Alternatives 1 and 2

This district contains a large amount of winter range for elk (30.6 mile^2) and moose (54.8 mile^2), along with a moderate amount of bighorn sheep winter range (9.7 mile^2) (Table 3.2.5). These alternatives would have among the highest densities of designated winter travel routes (mostly

groomed snowmobile trails) within elk (1.2 mi/sq mi) and moose (0.8 mi/sq mi) winter range on the Forest (Table 3.2.6). Additionally, only 26% of elk winter range and 5% of moose winter range would be closed to snowmobile use off designated routes (Table 3.2.7). Portions of this district provide an extremely popular snowmobile destination. Disturbance and displacement of wintering elk and moose would be high. There would be no designated winter travel routes in bighorn sheep winter range, and almost all (95%) of it would be closed to snowmobile use off designated routes (Table 3.2.7). Effects of these alternatives on bighorn sheep winter range would therefore be low.

Alternative 3

This alternative would have the greatest effect on elk and moose winter range, because the density of designated winter travel routes (1.3 mi/sq mi) would be the highest while the area closed to snowmobile use (27%) would remain low (Table 3.2.6 and 3.2.7). The amount of bighorn sheep winter range closed to snowmobile use off designated routes would decrease to 81%, the lowest among all alternatives (Table 3.2.7). However, the impacts of this change would be negligible because the open areas have low snow depth and are inaccessible to snowmobiles.

Alternative 4

The effects of this alternative on elk, moose, and bighorn sheep winter range would be very similar to those described for Alternatives 1 and 2 because the density of designated winter travel routes would be the same and percentage of winter range for these species closed to snowmobile use would increase to 100% for bighorn sheep and be the same for other species (Table 3.2.7).

Alternatives 5 and 6

The density of designated winter travel routes within elk and moose winter range would be the same or lower than in Alternatives 1 and 2, but the percentage of winter range closed to snowmobile use off designated routes would increase to 53% for elk and 21% for moose (Table 3.2.7). Effects to moose and elk would therefore be lower. Effects of this alternative on bighorn sheep winter range would be the same as those described under Alternatives 1 and 2.

Alternative 7-M

The density of designated winter travel routes within elk (1.2 mi/sq mi) and moose (0.8 mi/sq mi) winter range would be the same as in Alternatives 1 and 2 (Table 3.2.6). The amount of area closed to snowmobile use in elk (32%) and moose (15%) winter range would be lower than in Alternatives 5 and 6, but greater than under the other alternatives (Table 3.2.7). Effects to wintering elk and moose would therefore be intermediate among Alternatives 1, 2, 5 and 6. All bighorn sheep winter range would be closed to snowmobiling and there would be no designated winter travel routes through bighorn sheep winter range, so effects would be negligible.

District 362 (South Madison)

Effects common to all alternatives

This district contains a large amount of winter range for elk (31.5 mile^2), moose (37.3 mile^2), and goats (34.2 mile^2), along with some bighorn sheep winter range (3.2 mile^2) in the Lionhead TPA north of Earthquake Lake and the Madison River (Table 3.2.5). There would be no designated winter travel routes in winter range for both bighorn sheep and goats (Table 3.2.7). Additionally, all sheep and goat winter range would be closed to snowmobile use in Alternatives 3 through 7-M

(Table 3.2.7). It would be open to snowmobile use in Alternatives 1 and 2, but the sheep and goat winter range in this district is inaccessible to snowmobiles due to steep terrain and low snow cover. Additionally, there is the constraint of the surrounding designated Wilderness where snowmobile use is not allowed. Therefore, effects of winter travel on bighorn sheep and mountain goats would be very low among all alternatives.

Alternatives 1 and 2

There would be a moderate density (0.3 mi/sq mi) of designated winter travel (snowmobile) routes within moose and elk winter range (Table 3.2.6). Only 26% of the elk and moose winter range in the district would be closed to snowmobile use off designated routes (Table 3.2.7). Therefore effects to elk and moose winter range would be moderate to high.

Alternatives 3-5

The density of designated winter travel routes would remain the same as in Alternatives 1 and 2, but the amount of elk and moose winter range closed to snowmobile use off designated routes would increase to 38-43% (Table 3.2.7). Effects on moose and elk winter range would therefore but lower than under Alternatives 1 and 2.

Alternatives 6

This alternative would have the fewest effects on elk and moose winter range. There would be a decrease in the density of designated winter travel routes (0.2 mi/sq mi), and most (82-85%) elk and moose winter range would be closed to snowmobile use off designated routes (Table 3.2.6 and 3.2.7).

Alternative 7-M

The effects of this alternative would be the same as those under Alternatives 3-5.

District 393 (East Bridger)

Effects common to all alternatives

This district contains a large amount of moose winter range (74.8 mile^2), but relatively small amounts of elk (9.8 mile^2) and mountain goat (0.5 mile^2) winter range (Table 3.2.5). Under all alternatives, there would be no designated winter travel routes in elk or mountain goat winter range (Table 3.2.6) but little or none of this area would be closed to snowmobile use off designated routes (Table 3.2.7). Some displacement and disturbance of wintering goats would be expected under all alternatives, but these effects would be low given the limited amount of winter range present for them. Effects to wintering elk would be greater because of the larger area of winter range for this species. There are no bighorn sheep in the Bridger Range, so winter travel would not be an issue for this species.

Alternatives 1 and 2

This district would have some of the highest densities of designated winter travel routes within moose winter range (0.6 mi/sq mi) of any district on the Forest (Table 3.2.6). There would be a mix of both snowmobile and ski/snowshoe routes in the Bangtails TPA. Additionally, the amount of moose winter range closed to snowmobile use (1-5%) would be low (Table 3.2.7). The potential for disturbance and displacement of moose during the winter would be high.

Alternatives 3 and 4

This alternative would have an increase in designated winter travel routes within moose winter range (0.7 mi/sq mi), but the amount of moose winter range closed to snowmobile use off designated routes (5%) would remain the same as in Alternatives 1 and 2 (Tables 3.2.6 and 3.2.7). Effects on wintering moose would therefore be greater.

Alternative 5

This alternative would have the lowest density of designated winter travel routes within moose winter range (0.5mi/sq mi), and therefore the fewest effects on wintering moose (Table 3.2.6).

Alternatives 6 and 7-M

Effects of these alternatives would be the same as those described under Alternatives 3 and 4.

District 560 (Boulder River-Deer Creeks)

Effects common to all alternatives

There is a large amount of elk (66.6 mile^2) and moose (62.2 mile^2) winter range in this district, along with some important bighorn sheep (1.9 mile^2) and mountain goat (9.0 mile^2) winter range (Table 3.2.5). There would be approximately 0.4 mi/sq mi of designated winter travel routes within moose winter range, and 0.2 mi/sq mi within elk winter range (Table 3.2.6). Approximately 52-53% of moose winter range and 16-18% of elk winter range would be closed to snowmobile use under all alternatives (Table 3.2.7). Most of the elk winter range is located in areas that are not conducive to snowmobile use due to low snow cover, therefore effects of all alternatives on elk winter range would be low. Effects of winter travel on moose would be moderate, given the density of designated winter travel routes and percentage of area closed to snowmobile use. There would be no designated winter travel routes through sheep and goat winter range, and their winter range would be almost entirely closed to snowmobile use. Effects of winter travel on those species would be very low for all alternatives.

District 580 (East Slope Crazy Mountains)

Effects common to all alternatives

This district contains important winter range for elk (18.7 mile^2) and mountain goats (18.6 mile^2) in the Crazy Mountains (Table 3.2.5). There is no moose winter range in this district, and bighorn sheep are not found in the Crazy Mountains, so winter travel is not an issue for these species.

Alternatives 1 and 2

There would be no designated winter travel routes in elk or mountain goat winter range (Table 3.2.6). All elk and mountain goat winter range would be open to unrestricted snowmobile use, but snowmobile use would be limited by low snow cover at lower elevations and little legal public access (Table 3.2.7). Therefore, effects to wintering elk and mountain goats would be relatively low.

Alternatives 3 through 7-M

As in Alternatives 1 and 2, there would be no designated winter travel routes in elk or mountain goat winter range (Table 3.2.6). However, there would be a larger percentage of elk (38%) and goat (68%) winter range closed to snowmobile use (Table 3.2.7). Effects to wintering elk and goats would therefore be less than in Alternatives 1 and 2.

Table 3.2. 1 MFWP elk/deer hunting districts on the Gallatin National Forest used to analyze effects of Travel Plan alternatives on big game.

MFWP Hunting District	Hunting District Name	Area (mi^2) within Gallatin National Forest	Corresponding TPAs
301	Hyalite-Portal	294	Bear Canyon, Bozeman Cr, Hyalite, Gallatin Roaded, Gallatin River Canyon, Gallatin Crest, Porcupine Buffalo Horn
310	Upper Gallatin	212	Taylor Fork, Porcupine Buffalo Horn, LM Wilderness Hilgards, LM Wilderness Monument
311	Lower Gallatin	154	LM Wilderness Spanish Peaks, Cherry Creek, Gallatin River Canyon
312	West Bridger	106	West Bridger South, West Bridger North, Fairy Lake, Bridger Canyon
313	Gardiner	161	Gardiner Basin, AB Wilderness, Yankee Jim Canyon, Mill Creek
314	Upper Yellowstone West	288	Yankee Jim Canyon, Sawtooth, Tom Miner Rock, Gallatin Crest, Yellowstone, Bear Canyon
315	West Slope Crazy Mountains	129	Ibex, East Crazies, Shields
316	Absaroka	409	AB Wilderness, AB Beartooth Plateau, Cooke City
317	Upper Yellowstone East	274	AB Wilderness, Mission, Mill Creek
360	North Madison	122	Taylor Fork, Big Sky, LM Wilderness Spanish Peaks
361	Hebgen-Upper Madison	211	Lionhead, South Plateau, Hebgen Lake Basin
362	South Madison	153	Cabin Creek, Lionhead, Hebgen Lake Basin, LM Wilderness Hilgard, LM Wilderness Monument
393	East Bridger	130	Bangtails, North Bridger, Fairy Lake
560	Boulder River-Deer Creeks	500	AB Wilderness, Mission, Main Boulder, East Boulder, Deer Creeks
580	East Slope Crazy Mountains	126	East Crazies

Table 3.2. 2 Density (mi/sq mi) of open roads in elk/deer hunting districts by alternative for summer motorized travel, calculated for Forest Service roads only and for all roads. Densities are ranked from high to low.*

Hunting District	Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6		Alt. 7-M	
	FS roads	All roads	FS roads	All roads	FS roads	All roads	FS roads	All roads	FS roads	All roads	FS roads	All roads	FS roads	All roads
301	0.8	1.0	0.8	1.0	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.8	1.1
310	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3
311	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
312	0.5	1.1	0.5	1.1	0.5	1.1	0.5	1.1	0.5	1.1	0.5	1.1	0.5	1.1
313	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.3	0.4

Hunting District	Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6		Alt. 7-M	
	FS roads	All roads	FS roads	All roads	FS roads	All roads	FS roads	All roads	FS roads	All roads	FS roads	All roads	FS roads	All roads
314	0.3	1.0	0.3	1.0	0.3	1.0	0.3	1.0	0.3	1.0	0.3	1.0	0.3	1.0
315	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0
316	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
317	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
360	0.2	2.3	0.2	2.3	0.2	2.3	0.2	2.3	0.2	2.3	0.2	2.3	0.2	2.3
361	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.3	1.1	1.2	1.1	1.2	1.1	1.2
362	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.2
393	0.5	2.0	0.5	2.0	0.5	2.0	0.5	2.0	0.5	2.0	0.5	2.0	0.5	2.0
560	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
580	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5
TOTAL	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.6	0.3	0.6	0.3	0.6

*road density categories example only, high = 1.5-2.0, medium – 1.0-1.4, low = .5-.9, very low = .0-.4

Table 3.2. 3 Density (mi/sq mi) of open routes (roads and trails) in elk/deer hunting districts, by alternative for summer motorized travel, calculated for Forest Service routes only and for all routes.

Hunting District	Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6		Alt. 7-M	
	FS routes	All routes	FS routes	All routes	FS routes	All routes	FS routes	All routes	FS routes	All routes	FS routes	All routes	FS routes	All routes
301	1.2	1.5	1.2	1.5	1.3	1.5	1.2	1.5	1.1	1.4	1.0	1.2	1.2	1.4
310	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.5	0.5	0.2	0.3	0.5	0.5
311	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
312	1.0	1.5	1.0	1.6	0.9	1.5	0.7	1.3	0.6	1.1	0.5	1.1	0.8	1.4
313	0.3	0.5	0.3	0.5	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.3	0.4
314	0.6	1.3	0.6	1.3	0.5	1.2	0.4	1.1	0.3	1.0	0.3	1.0	0.3	1.1
315	1.0	1.4	0.9	1.4	1.2	1.7	0.9	1.4	0.8	1.3	0.6	1.1	0.7	1.2
316	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
317	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4
360	0.3	2.4	0.3	2.4	0.4	2.5	0.4	2.5	0.4	2.5	0.2	2.3	0.4	2.5
361	1.3	1.4	1.3	1.4	1.3	1.4	1.3	1.4	1.2	1.3	1.1	1.3	1.2	1.3
362	0.5	0.6	0.4	0.5	0.4	0.5	0.4	0.4	0.4	0.4	0.2	0.3	0.3	0.4
393	0.7	2.3	0.7	2.3	0.8	2.4	0.7	2.2	0.7	2.2	0.6	2.2	0.8	2.3
560	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.3
580	0.2	0.6	0.2	0.6	0.2	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.2	0.6
TOTAL	0.5	0.9	0.5	0.8	0.5	0.8	0.5	0.8	0.4	0.7	0.4	0.7	0.5	0.8

*road density categories example only, high = 2.0-2.5, medium – 1.5-2.0, low = 1.0-1.5, very low = .0-.1.0

Table 3.2. 4 Percentage of secure elk habitat in elk/deer hunting districts by alternatives for summer motorized travel. Secure habitat values were calculated using all routes open to passenger car or ATVs within the Forest boundary.

Hunting District	Percent Secure Elk Habitat						
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7-M
301	21	31	32	33	34	34	33
310	58	64	68	68	70	73	69
311	82	86	86	86	86	86	86
312	24	49	51	51	52	52	51
313	68	69	70	70	70	70	68
314	36	51	54	54	54	54	54
315	25	31	34	37	37	38	35
316	94	94	94	94	94	94	94
317	76	77	78	78	78	78	78
360	27	27	25	25	25	34	25
361	20	23	22	22	24	26	24
362	58	66	70	70	77	77	76
393	7	11	12	12	12	12	12
560	71	76	79	77	80	80	80
580	67	70	69	70	70	71	70
TOTAL	55	60	62	62	63	64	62

*high =70-100, medium = 40-69, low = 20-39, very low = 0-19

Table 3.2. 5 Area (mile^2) of big game winter ranges within hunting districts on the Gallatin National Forest.

Hunting District	Elk Winter Range (mile^2)	Moose Winter Range (mile^2)	Bighorn Sheep Winter Range (mile^2)	Mountain Goat Winter Range (mile^2)
301	76.9	33.7	18.2	0
310	102.1	81.1	0.1	14.6
311	35.4	8.5	18.9	61.0
312	1.6	19.4	0	16.5
313	58.7	7.2	9.5	0
314	49.5	31.3	19.5	0
315	0	17.7	0	3.4
316	39.7	27.9	4.9	2.7
317	23.2	39.8	0	0
360	23.3	12.0	2.0	15.8
361	30.6	54.8	9.7	0.2
362	31.5	37.3	3.2	34.2
393	9.8	74.8	0	0.5
560	66.6	62.2	1.9	9.0
580	18.7	0	0	18.6
TOTAL	567.6	507.7	87.9	176.5

Table 3.2. 6 Density (mi/sq mi) of groomed and designated snowmobile, cross-country ski, and snowshoe routes within elk, moose, bighorn sheep, and mountain goat winter range by hunting district, by alternative.

Hunting District	Species	Density (mi/sq mi) Groomed/Designated Winter Trails						
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7-M
301	Elk	0.6	0.6	0.7	0.7	0.6	0.7	0.7
	Moose	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Sheep	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	Goat	0.0	0.0	0.0	0.0	0.0	0.0	0.0
310	Elk	0.2	0.2	0.3	0.2	0.2	0.1	0.2
	Moose	0.2	0.2	0.4	0.2	0.2	0.1	0.2
	Sheep	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Goat	0.0	0.0	0.0	0.0	0.0	0.0	0.0
311	Elk	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Moose	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Sheep	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Goat	0.0	0.0	0.0	0.0	0.0	0.0	0.0
312	Elk	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Moose	0.7	0.8	0.9	0.9	0.8	0.7	0.8
	Sheep	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Goat	0.0	0.0	0.0	0.0	0.0	0.0	0.0
313	Elk	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Moose	0.4	0.4	0.6	0.6	0.6	0.6	0.6
	Sheep	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Goat	N/A	N/A	N/A	N/A	N/A	N/A	N/A
314	Elk	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Moose	0.2	0.2	0.2	0.2	0.1	0.2	0.1
	Sheep	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Goat	N/A	N/A	N/A	N/A	N/A	N/A	N/A
315	Elk	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Moose	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sheep	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Goat	0.0	0.0	0.0	0.0	0.0	0.0	0.0
316	Elk	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Moose	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sheep	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Goat	0.0	0.0	0.0	0.0	0.0	0.0	0.0
317	Elk	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Moose	0.3	0.3	0.4	0.4	0.3	0.3	0.5
	Sheep	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Goat	N/A	N/A	N/A	N/A	N/A	N/A	N/A
360	Elk	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	Moose	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Sheep	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Goat	0.3	0.3	0.3	0.3	0.3	0.3	0.3
361	Elk	1.2	1.2	1.3	1.2	1.2	1.0	1.2
	Moose	0.8	0.8	0.9	0.8	0.8	0.8	0.8
	Sheep	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Goat	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Hunting District	Species	Density (mi/sq mi) Groomed/Designated Winter Trails						
362	Elk	0.3	0.3	0.3	0.3	0.3	0.2	0.3
	Moose	0.3	0.3	0.3	0.3	0.3	0.2	0.3
	Sheep	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Goat	0.0	0.0	0.0	0.0	0.0	0.0	0.0
393	Elk	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Moose	0.6	0.6	0.7	0.7	0.5	0.7	0.7
	Sheep	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Goat	0.0	0.0	0.0	0.0	0.0	0.0	0.0
560	Elk	0.0	0.0	0.0	0.2	0.2	0.2	0.2
	Moose	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Sheep	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Goat	0.0	0.0	0.0	0.0	0.0	0.0	0.0
580	Elk	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Moose	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sheep	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Goat	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	Elk	0.2	0.2	0.3	0.3	0.2	0.2	0.3
	Moose	0.4	0.4	0.5	0.5	0.4	0.4	0.4
	Sheep	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Goat	0.0	0.0	0.0	0.0	0.0	0.0	0.0

(N/A = no winter range for that species.) * high = 1.0-1.5, medium = .05-1.0, low = 0.0-0.5

Table 3.2. 7 Percentages of elk, moose, bighorn sheep and mountain goat winter range closed to snowmobiles off designated routes, by alternative.

Hunting District	Species	Percent Winter Range Closed to Snowmobiles						
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7-M
301	Elk	3	3	9	10	10	10	10
	Moose	8	8	27	28	28	28	28
	Sheep	0	0	13	34	34	34	34
	Goat	0	0	0	0	0	0	0
310	Elk	42	42	48	48	51	82	62
	Moose	47	47	50	50	50	87	66
	Sheep	77	77	77	77	77	77	77
	Goat	93	93	93	93	94	100	100
311	Elk	59	59	86	86	86	86	86
	Moose	16	16	73	73	73	73	73
	Sheep	75	75	98	98	98	98	98
	Goat	96	96	100	100	100	100	100
312	Elk	0	0	49	49	89	49	49
	Moose	4	5	13	13	14	13	14
	Sheep	0	0	0	0	0	0	0
	Goat	7	7	20	20	98	20	37
313	Elk	80	80	84	84	84	84	84
	Moose	30	30	31	31	31	31	31
	Sheep	89	89	92	92	92	92	92
	Goats	0	0	0	0	0	0	0
	Elk	26	26	39	39	46	40	54
	Moose	3	3	55	55	69	59	63

Hunting District	Species	Percent Winter Range Closed to Snowmobiles						
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7-M
314	Sheep	16	16	54	73	73	73	73
	Goat	0	0	0	0	0	0	0
315	Elk	0	0	0	0	0	0	0
	Moose	0	0	0	0	25	0	25
	Sheep	0	0	0	0	0	0	0
	Goat	0	0	6	6	83	6	54
316	Elk	100	100	100	100	100	100	100
	Moose	100	100	100	100	100	100	100
	Sheep	100	100	100	100	100	100	100
	Goat	99	99	99	99	99	99	99
317	Elk	30	30	30	30	63	30	37
	Moose	44	56	56	56	56	56	69
	Sheep	0	0	0	0	0	0	0
	Goat	0	0	0	0	0	0	0
360	Elk	4	4	8	9	9	10	10
	Moose	0	0	5	5	5	5	3
	Sheep	0	0	49	49	49	49	49
	Goat	57	57	86	86	86	86	86
361	Elk	26	26	27	27	53	53	32
	Moose	5	5	6	6	21	21	15
	Sheep	95	95	81	100	100	100	100
	Goat	5	5	98	98	98	98	98
362	Elk	26	26	40	40	43	82	40
	Moose	26	26	38	38	41	85	38
	Sheep	0	0	100	100	100	100	100
	Goat	78	78	100	100	100	100	100
393	Elk	0	0	0	0	0	0	0
	Moose	1	5	5	5	0	5	5
	Sheep	0	0	0	0	0	0	0
	Goat	0	0	0	0	28	0	0
560	Elk	16	16	17	17	18	17	17
	Moose	52	52	53	53	53	53	53
	Sheep	99	99	99	99	99	99	99
	Goat	100	100	100	100	100	100	100
580	Elk	0	0	38	38	38	38	38
	Moose	0	0	0	0	0	0	0
	Sheep	0	0	0	0	0	0	0
	Goat	0	0	68	68	68	68	68
TOTAL	Elk	35	35	43	43	47	53	48
	Moose	27	29	36	36	39	47	42
	Sheep	48	48	67	78	78	78	78
	Goat	68	68	85	85	94	86	88

Cumulative Effects

Net Effects of Past and Present Programs and Activities

Many of the activities that are managed on the Gallatin National Forest may have some affect on big game or big game habitat. The risk factors include programs, practices and activities that may

directly, indirectly, or cumulatively affect big game or big game habitat in four defined areas: 1) productivity, 2) mortality, 3) movement and dispersal and 4) large scale fragmentation of habitat.

The collective effects of past and present activities represent the baseline condition on the Gallatin Forest against which the alternatives were evaluated. Considering past and present vegetation management on the Gallatin Forest, which includes timber harvest, prescribed fire, other vegetation projects, and invasive species management, forest and vegetation conditions provide adequate habitat for foraging and security of big game species as proscribed by the Forest Plan. The effects of dispersed recreation, outfitter guide activities, recreation residences, fire suppression, lands activities, mineral management, non-recreation special uses, and developed ski areas have negligible, or beneficial, effects to big game species other than what was considered.

Projected Combined Effects of Reasonably Foreseeable Programs and Activities

Big game species inhabit almost all areas of the Gallatin National Forest during different seasons annually. Some species are localized in specific areas year-round, while others migrate seasonally from summer to winter range. Addressing the effects of reasonably foreseeable activities for of these species collectively is difficult and subjective. However, the following is an attempt to summarize the cumulative affects from all activities on the Gallatin Forest and the potential effects to big game species that occur within and adjacent to National Forest.

There will be no cumulative affects expected to occur from timber harvest, prescribed fire, livestock grazing, invasive species or other vegetation projects. Reasonably foreseeable projects on the Gallatin National Forest would most likely treat a variety of forest types in a variety in varying ways to meet different objectives. Fire salvage, fuel reduction, and restoration of fire adapted systems are a few examples. Livestock grazing will continue occur and evolve under adaptive management goals irregardless of travel management. These efforts are consistent with the Forest Plan and cooperative objectives for big game and big game habitat.

Future wildfire event cannot be predicted, or our success and methods in suppressing these events when they do occur. Big game species will generally benefit from managed wildfire in the landscape because fire altered landscapes provide needed foraging habits which are more limited on the Gallatin Forest than Security areas.

No cumulative impacts to big game are expected from minerals, lands, and non-recreation special use programs. New mineral development activities are no anticipated other than existing sites and abandoned mine reclamation. The consolidation of National Forest Lands would likely continue and would provide more unbroken habitat for big game. Temporary special uses have minor individual impacts, but may collectively contribute to large scale effects on big game. Predicting the number and scale of these types of permitted action is difficult, so the significance of this effect is not known.

Cumulative effects of dispersed summer and winter recreation use along with other activities in big game habitat such as the outfitter guides and recreational residences were considered through

analysis as part of the baseline. The Forest Plan does not recommend limits to these activities specific to big game management.

Road improvement and road construction adjacent to National Forest has shown decreasing trends. Trends to update travel plans on adjacent National Forest have further limited negative impacts to big game associated with disturbance, displacement and mortality caused by humans; although, road construction on private lands may contribute to these risk factors.

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

The critical areas of cumulative effects identified for big game included three areas of emphasis; elk use and summer travel, elk vulnerability and summer travel, and winter travel and big game. These emphasis areas are affected specifically by activities and programs that involve dispersed recreation in summer and winter, and any motorized activities on roads and trails. The following analysis summarizes these effects by Travel Plan alternative.

Currently, most elk populations on the Forest are in stable or increasing trends and are above population goals. However, elk populations are dynamic and fluctuate based on many factors beyond management of Forest Service roads and trails. Several reasonably foreseeable circumstances may affect future summer elk habitat availability and quality on the Forest. The population of western Montana will continue to increase, and summer recreational use of the Gallatin National Forest will likely continue to increase. Development on private lands within the Forest boundary will continue as well, leading to loss of summer elk habitat and the potential for increases in motorized access on private lands.

Numerous factors are known to affect elk vulnerability to hunting, many of which will contribute to increased vulnerability of elk in the foreseeable future. The population of western Montana is rising, and elk hunting pressure is likely to rise as well, because the Gallatin National Forest provides some of the most recognized elk hunting opportunities in the state. Coupled with this is that a substantial segment of the hunting culture is increasingly focused on harvesting large bulls rather than antlerless elk, which further increases mortality of bulls. In areas where they are allowed, the increasing popularity of ATVs for hunting, along with the improved capability of ATVs to navigate difficult terrain, make bull elk more vulnerable to hunting by increased hunting pressure. As a result, adequate secure habitat is likely to become more important in the future.

Several factors are likely to lead to increasing impacts on wintering big game animals on the Gallatin National Forest. One is that the population of western Montana continues to increase, a trend that is likely to continue for the foreseeable future. This will lead to increases in winter travel as more people engage in snowmobiling, skiing, and snowshoeing. When combined with increased technology for winter recreational equipment, especially snowmobiles, more people are able to access difficult terrain that historically was not reachable. This is especially true for some portions of bighorn sheep and mountain goat winter range. Other factors likely to affect big game winter range include loss of habitat due to increasing residential development of private lands, loss of moose winter range from wildfires in forested stands with subalpine fir understories, and potential reductions in forage production on winter range from the spread of weeds. As a result, areas of

winter range on public lands, where big game can fulfill their needs relatively free from human disturbance, will likely be increasingly important in the future.

Alternative 1

On a Forest-wide scale, open motorized route density (including both open roads and trails) would be 0.9 mi/sq mi, compared to 0.5 mi/sq mi when only Forest Service routes were considered (Table 3.2.3). Forest Service routes would generally contribute more towards cumulative effects on summer elk habitat than non-Forest Service routes, which is the opposite of the conclusion reached when only open roads were considered. However, the actual contribution of Forest Service versus non-Forest Service routes towards cumulative effects on summer elk habitat would vary among districts (Table 3.2.3). Two districts would have open motorized route densities >2.0 mi/sq mi, and cumulative effects to summer elk habitat would be highest in these districts. Five districts would have open motorized route densities from 1.0-1.9 mi/sq mi, and cumulative effects to summer elk habitat would be more moderate here. However, the effects on summer elk habitat could be important given the reasonably foreseeable changes described above. The remaining eight districts would have open motorized route densities <1.0 mi/sq mi, and cumulative effects on summer elk habitat would be low.

Cumulative effects of Forest Service summer travel on elk vulnerability to hunting would be highest under this alternative. On a Forest-wide scale, there would be approximately 55% secure elk habitat available (Table 3.2.4). Six districts would have less than the recommended 30% secure habitat, and bull elk vulnerability to hunting would be high. Four districts would have a high percentage of secure habitat (>70%), and elk vulnerability would likely not be an issue. The remaining five districts would have more moderate amounts of secure elk habitat, and it is uncertain whether it would be adequate, given the reasonably foreseeable changes described above that could affect elk vulnerability. However, the actual effects of this alternative on elk vulnerability would be greater than what the analysis shows, because the off-trail prohibition on summer motorized use would not be included and areas analyzed as secure habitat could, in some cases, be receiving ATV or passenger car use.

The alternative would have a lower amount of winter range for elk, moose, bighorn sheep, and mountain goat closed to snowmobile use off designated routes. However, densities of designated winter travel routes within big game winter range would be among the lowest of all alternatives. There would be moderate cumulative effects on elk and moose winter range on a Forest-wide scale, but the greatest cumulative effects on bighorn sheep and mountain goat winter range. This is because the area of bighorn sheep and mountain goat winter range closed to snowmobile use is generally much more important in determining effects for these species than is density of designated winter travel routes. Densities of winter travel routes within winter range for sheep and goats would be zero or very low.

Alternative 2

Open motorized route densities would be very similar to Alternative 1, but cumulative effects to summer elk habitat would be lower because off-trail summer motorized use would be prohibited across the Forest.

Cumulative effects of Forest Service summer travel on elk vulnerability to hunting would be lower than under Alternative 1. The percentage of secure elk habitat available Forest-wide would increase to 60% (Table 3.2.4). Additionally, off-trail summer motorized use would be prohibited. Three districts would have less than the recommended minimum 30% secure habitat, where bull elk vulnerability to hunting would be high. Five districts would have a high percentage of secure habitat (>70%), and elk vulnerability would likely not be an issue (Table 3.2.4). The remaining seven districts would have more moderate amounts of secure elk habitat, and it is uncertain whether it would be adequate given the reasonably foreseeable changes described above that could affect elk vulnerability. This alternative would have similar effects from winter travel on big game species as described for Alternative 1 above.

Alternative 3 and 4

This alternative would generally have the highest open motorized route densities, and therefore the greatest cumulative effects on summer elk habitat (Table 3.2. 3). Open motorized route densities on a Forest-wide scale and resulting cumulative effects to summer elk habitat would be similar to those described under Alternatives 1 and 2.

On a Forest-wide scale, secure elk habitat would increase to 62% under these alternatives, and cumulative effects on elk vulnerability would be lower than for Alternatives 1 or 2 (Table 3.2.4). The same three districts would have less than the recommended 30% minimum secure habitat. Six districts would have a high percentage of secure habitat (>70%), and elk vulnerability would likely not be an issue. The remaining six districts would have more moderate amounts of secure elk habitat, and it is uncertain whether it would be adequate given the reasonably foreseeable changes described above that could affect elk vulnerability.

These alternatives would have the highest cumulative effects on elk and moose winter range. Densities of designated winter travel routes would be the highest of all alternatives, but there would be relatively small increases in the percentage of elk and moose winter range closed to snowmobile use off designated routes. Cumulative effects of winter travel on sheep and goat winter range would lower than under Alternatives 1 and 2, because there would a higher percentage of winter range closed to snowmobile use off designated routes.

Alternative 5 and 6

There would be a decrease in open motorized route density across the Forest compared to Alternatives 1 and 2. Cumulative effects to summer elk habitat would therefore be lower. These alternatives would have the lowest open motorized route densities on a Forest-wide scale, and cumulative effects to summer elk habitat would generally be lowest. Only two districts would have total open motorized route density >2.0 mi/sq mi, five districts would have open motorized route density of 1.0-1.9 mi/sq mi, and eight districts would have <1.0 mi/sq mi open motorized route density.

These alternatives would have the fewest cumulative effects on elk vulnerability. Secure elk habitat would increase to 63-64% Forest-wide under these alternatives (Table 3.2.4). The same three districts would have less than the recommended 30% minimum secure habitat. Two more districts would have a high percentage of secure habitat (>70%) where elk vulnerability would likely not be an issue compared to Alternative 4. Four districts would have more moderate amounts of secure elk

habitat, and it is uncertain whether it would be adequate given the reasonably foreseeable changes described above that could affect elk vulnerability.

These alternatives would have the lowest cumulative effects on elk and moose winter range. The density of designated winter travel routes in elk and moose winter range would be similar to Alternatives 1 and 2, but the percentage of winter range closed to snowmobile use off designated routes would be greater than under the other alternatives. Cumulative effects to sheep and goat winter range would also be lower than under any alternative, because most of their winter range would be closed to snowmobile use.

Alternative 7-M

On a Forest-wide scale, the cumulative effects of this alternative would be similar to those described under Alternative 5. The cumulative effects of this alternative on elk vulnerability would be similar to those described under Alternative 3 and 4. Cumulative effects to moose, sheep and goat winter range would be similar to those described under Alternatives 5 and 6. Cumulative effects to elk winter range would be slightly greater than Alternatives 5 and 6, due to an increase in designated winter travel routes within elk winter range.

Elk Habitat Use and Summer Travel

Currently, most elk populations on the Forest are in stable or increasing trends and are above population goals. However, elk populations are dynamic and fluctuate based on many factors beyond management of Forest Service roads and trails. Several reasonably foreseeable circumstances may affect future summer elk habitat availability and quality on the Forest. The population of western Montana will continue to increase, and summer recreational use of the Gallatin National Forest will likely continue to increase. Development on private lands within the Forest boundary will continue as well, leading to loss of summer elk habitat and the potential for increases in motorized access on private lands.

Effects common to all alternatives

On a Forest-wide scale, the open road density (considering both Forest Service and non-Forest Service roads) would be approximately 0.7 mi/sq mi, or more than twice what the open road density would be when only Forest Service open roads are considered (Table 3.2.3). Private roads therefore contribute more towards cumulative effects on summer elk habitat than Forest Service open roads. However, the actual contribution of private versus Forest Service roads towards cumulative effects on summer elk habitat would vary considerably among hunting districts, as some would have a very high proportion of non-Forest Service roads, while others would have almost none. Two hunting districts (360 and 393) would have open road densities >2.0 mi/sq mi, which would exceed recommendations for management of open roads within summer elk habitat (Christensen et al. 1993:2-3, Canfield et al. 1999:6.12). Cumulative effects of open roads on summer elk habitat would be highest in these districts, but both of them have a high proportion of non-Forest Service roads. In these cases, management of Forest Service open roads would have relatively little effect on total open road densities. Five districts would have open road densities from 0.7-1.9 mi/sq mi, which is consistent with Christensen et al.'s (1999:2-3) recommendations for managing open roads in areas where elk are a primary resource consideration, but exceeds Canfield et al.'s (1999:6.12) recommendations to manage roads at <1.0 mi/sq mi for summer elk habitat. The cumulative effects

of open road density would be lower in these five districts than in the two first mentioned, but the effects on summer elk habitat could be important given the reasonably foreseeable changes described above. The remaining eight districts would have open road densities <1.0 mi/sq mi, which is consistent with recommendations by Canfield et al. (1999:6.12) to manage open road density in summer elk habitat, and Christensen et al.'s (1993:2-3) recommendation to manage open road density at <0.7 mi/sq mi for areas intended to benefit elk summer habitat and retain high use. Cumulative effects of open roads would be lowest in these districts.

Alternative 1

On a Forest-wide scale, open motorized route density (including both open roads and trails) would be 0.9 mi/sq mi, compared to 0.5 mi/sq mi when only Forest Service routes were considered (Table 3.2.3). Forest Service routes would generally contribute more towards cumulative effects on summer elk habitat than non-Forest Service routes, which is the opposite of the conclusion reached when only open roads were considered. However, the actual contribution of Forest Service versus non-Forest Service routes towards cumulative effects on summer elk habitat would vary among districts (Table 3.2.3). Two districts would have open motorized route densities >2.0 mi/sq mi, and cumulative effects to summer elk habitat would be highest in these districts. Five districts would have open motorized route densities from 1.0-1.9 mi/sq mi, and cumulative effects to summer elk habitat would be more moderate here. However, the effects on summer elk habitat could be important given the reasonably foreseeable changes described above. The remaining eight districts would have open motorized route densities <1.0 mi/sq mi, and cumulative effects on summer elk habitat would be low (Table 3.2.3).

Alternative 2

Open motorized route densities would be very similar to Alternative 1, but cumulative effects to summer elk habitat would be lower because off-trail summer motorized use would be prohibited across the Forest.

Alternative 3

This alternative would generally have the highest open motorized route densities, and therefore the greatest cumulative effects on summer elk habitat (Table 3.2.3).

Alternative 4

Open motorized route densities on a Forest-wide scale and resulting cumulative effects to summer elk habitat would be similar to those described under Alternatives 1 and 2.

Alternative 5

There would be a decrease in open motorized route density across the Forest compared to Alternatives 1 and 2. Cumulative effects to summer elk habitat would therefore be lower.

Alternative 6

This alternative would have the lowest open motorized route densities on a Forest-wide scale, and cumulative effects to summer elk habitat would generally be lowest. Only two districts would have total open motorized route density >2.0 mi/sq mi, five districts would have open motorized route density of 1.0-1.9 mi/sq mi, and eight districts would have <1.0 mi/sq mi open motorized route density (Table 3.2.3).

Alternative 7-M

On a Forest-wide scale, the cumulative effects of this alternative would be similar to those described under Alternative 5.

Elk Vulnerability and Summer Travel

Numerous factors are known to affect elk vulnerability to hunting, many of which will contribute to increased vulnerability of elk in the foreseeable future. The population of western Montana is rising, and elk hunting pressure is likely to rise as well, because the Gallatin National Forest provides some of the most recognized elk hunting opportunities in the state. Coupled with this is that a substantial segment of the hunting culture is increasingly focused on harvesting large bulls rather than antlerless elk, which further increases mortality of bulls. Advances in technology for hunting equipment also increase elk vulnerability (Loftus 1991:273). In areas where they are allowed, the increasing popularity of ATVs for hunting, along with the improved capability of ATVs to navigate difficult terrain, make bull elk more vulnerable to hunting by increased hunting pressure. As a result, adequate secure habitat is likely to become more important in the future.

Alternative 1

Cumulative effects of Forest Service summer travel on elk vulnerability to hunting would be highest under this alternative. On a Forest-wide scale, there would be approximately 55% secure elk habitat available (Table 3.2.4). Six districts would have less than the recommended 30% secure habitat, and bull elk vulnerability to hunting would be high. Four districts would have a high percentage of secure habitat (>70%), and elk vulnerability would likely not be an issue. The remaining five districts would have more moderate amounts of secure elk habitat, and it is uncertain whether it would be adequate, given the reasonably foreseeable changes described above that could affect elk vulnerability. However, the actual effects of this alternative on elk vulnerability would be greater than what the analysis shows, because the off-trail prohibition on summer motorized use would not be included and areas analyzed as secure habitat could, in some cases, be receiving ATV or passenger car use.

Alternative 2

Cumulative effects of Forest Service summer travel on elk vulnerability to hunting would be lower than under Alternative 1. The percentage of secure elk habitat available Forest-wide would increase to 60% (Table 3.2.4). Additionally, off-trail summer motorized use would be prohibited. Three districts would have less than the recommended minimum 30% secure habitat, where bull elk vulnerability to hunting would be high. Five districts would have a high percentage of secure habitat (>70%), and elk vulnerability would likely not be an issue. The remaining seven districts would have more moderate amounts of secure elk habitat, and it is uncertain whether it would be adequate given the reasonably foreseeable changes described above that could affect elk vulnerability.

Alternatives 3 and 4

On a Forest-wide scale, secure elk habitat would increase to 62% under these alternatives, and cumulative effects on elk vulnerability would be lower than for Alternatives 1 or 2 (Table 3.2.4). The same three districts would have less than the recommended 30% minimum secure habitat. Six districts would have a high percentage of secure habitat (>70%), and elk vulnerability would likely

not be an issue. The remaining six districts would have more moderate amounts of secure elk habitat, and it is uncertain whether it would be adequate given the reasonably foreseeable changes described above that could affect elk vulnerability.

Alternatives 5 and 6

These alternatives would have the fewest cumulative effects on elk vulnerability. Secure elk habitat would increase to 63-64% Forest-wide under these alternatives (Table 3.2.4). The same three districts would have less than the recommended 30% minimum secure habitat. Two more districts would have a high percentage of secure habitat (>70%) where elk vulnerability would likely not be an issue compared to Alternative 4. Four districts would have more moderate amounts of secure elk habitat, and it is uncertain whether it would be adequate given the reasonably foreseeable changes described above that could affect elk vulnerability.

Alternative 7-M

The cumulative effects of this alternative on elk vulnerability would be similar to those described under Alternative 4.

Winter Travel and Big Game

Several factors are likely to lead to increasing impacts on wintering big game animals on the Gallatin National Forest. One is that the population of western Montana continues to increase, a trend that is likely to continue for the foreseeable future. This will lead to increases in winter travel as more people engage in snowmobiling, skiing, and snowshoeing. When combined with increased technology for winter recreational equipment, especially snowmobiles, more people are able to access difficult terrain that historically was not reachable. This is especially true for some portions of bighorn sheep and mountain goat winter range. Other factors likely to affect big game winter range include loss of habitat due to increasing residential development of private lands, loss of moose winter range from wildfires in forested stands with subalpine fir understories, and potential reductions in forage production on winter range from the spread of weeds. As a result, areas of winter range on public lands, where big game can fulfill their needs relatively free from human disturbance, will likely be increasingly important in the future.

Effects common to all alternatives

On a Forest-wide scale, cumulative effects for moose would be higher than for other species, because there would be higher densities of designated winter travel routes (Table 3.2.6) and lower area of winter range closed to snowmobile use off designated routes (Table 3.2.7). Cumulative effects of winter travel would be greatest in Districts 312, 361 and 393, which contain large areas of moose winter range, have the highest densities of designated winter travel routes and the lowest amount of area closed to snowmobile use. This is especially true for District 361, where moose populations have been declining since at least the early 1990s (K. Alt, MFWP, personal communication).

Cumulative effects to elk winter range would be lower than for moose, because the density of winter travel routes would be lower with a larger area closed to snowmobile use off designated routes. This is partly because elk winter range is more likely to be in areas with lower snow cover that is less conducive to winter travel. Cumulative effects to elk winter range would be highest in

Districts 301 and 361, which both contain a relatively large area of elk winter range, and have high densities of designated winter travel routes with a low percentage of winter range closed to snowmobile use off designated routes.

Cumulative effects to bighorn sheep and mountain goats would be lower than for elk and moose, because there would be few or no designated winter travel routes and a higher percentage of winter range closed to snowmobile use off designated routes in their winter range.

Alternatives 1 and 2

These alternatives would have the lowest amount of winter range for elk, moose, bighorn sheep, and mountain goat closed to snowmobile use off designated routes. However, densities of designated winter travel routes within big game winter range would be among the lowest of all alternatives. There would be moderate cumulative effects on elk and moose winter range on a Forest-wide scale, but the greatest cumulative effects on bighorn sheep and mountain goat winter range. This is because the area of bighorn sheep and mountain goat winter range closed to snowmobile use is generally much more important in determining effects for these species than is density of designated winter travel routes. Densities of winter travel routes within winter range for sheep and goats would be zero or very low.

Alternatives 3 and 4

These alternatives would have the highest cumulative effects on elk and moose winter range. Densities of designated winter travel routes would be the highest of all alternatives, but there would be relatively small increases in the percentage of elk and moose winter range closed to snowmobile use off designated routes. Cumulative effects of winter travel on sheep and goat winter range would lower than under Alternatives 1 and 2, because there would a higher percentage of winter range closed to snowmobile use off designated routes.

Alternatives 5 and 5

These alternatives would have the lowest cumulative effects on elk and moose winter range. The density of designated winter travel routes in elk and moose winter range would be similar to Alternatives 1 and 2, but the percentage of winter range closed to snowmobile use off designated routes would be greater than under the other alternatives. Cumulative effects to sheep and goat winter range would also be lower than under any alternative, because most of their winter range would be closed to snowmobile use.

Alternative 7-M

Cumulative effects to moose, sheep and goat winter range would be similar to those described under Alternatives 5 and 6. Cumulative effects to elk winter range would slightly greater than Alternatives 5 and 6, due to an increase in designated winter travel routes within elk winter range.

Effects of Proposed Goals, Objectives, Standards and Guidelines

Alternative 1 (No Action)

Under Alternative 1 (no action), 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 Plan was completed in 1987. Existing direction would result in maintaining the status quo, which would provide fewer protective measures than proposed for Alternatives 2 through 7-M.

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 big game 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 disturb in big game. 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 big game.

Restricting wheeled motorized travel to designated routes (**STANDARD A-6**) would significantly reduce the potential for motorized disturbance in big game habitat, reduce habitat alteration resulting from the development of user-created routes, lower human disturbance influence big game foraging habitats, 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 big game species by increasing human presence and associated disturbance factors in areas that currently serve as important big game security habitat and increasing the vulnerability of big game to legal and illegal hunting pressure.

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 big game species 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 big game species 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 big game species populations by acknowledging the importance of dispersal routes used by animals. Big game species are naturally wide-ranging herding animals and seasonal migration is an important mechanism for surviving winter conditions and maintaining genetic interaction among and between other populations. Fragmentation of bi game populations can result in lowered productivity and recruitment and increased vulnerability to predation and local extirpations.

Big game species use a variety of habitats both seasonally and diurnally and vary their foraging patterns regularly. As such, vegetative diversity provides a wide range of habitat options for big game species. Maintaining healthy vegetative conditions in key habitats such as willow, riparian, whitebark pine and old growth (**GOAL G, OBJ. G-1**) would provide for continued habitat diversity important to sustaining healthy big game populations.

Providing high quality security habitat in areas important to wildlife reproduction (**GOAL H, OBJ. H-1**) would benefit big game species by insuring the protection of big game reproductive habitat (calving and fawning areas) from human intrusions, and would also serve to promote productive big game foraging habitats in sensitive areas of the Forest.

Providing for habitat security on important ungulate winter range (**GOAL I, OBJ I-1**) would obviously benefit big game species by reducing the potential for human disturbance during an energy-critical time and thereby promoting better condition of females in the spring and thus recruitment of calves and fawns into the population.

Effective closure of project roads (**STANDARD L-1**) would benefit big game species 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 all big game species on the Forest. Also, stream courses are often used by big game species as for foraging, reproduction (calving and fawning) and travel corridors. Therefore, protecting stream courses and associated riparian habitat would benefit big game species.

STANDARD M-8 would effectively set a ceiling on public motorized access route density, which would also benefit big game species. **GUIDELINES M-9 and M-1**0 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 big game species.

Preserving the natural integrity of designated Wilderness Areas (**GOAL N** and associated standards and guidelines) would benefit big game species by preserving the characteristics of remote, rugged, and relatively inaccessible areas. Portions of many big game species summer range are located in wilderness, therefore protecting these areas and associated habitats would benefit big game species.

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 big game species 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 big game species would be essentially the same as described above for GOAL F in Alt. 2-6.

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 big game species 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 big game species.

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 Gallatin Forest Plan (USDA 1987:II-18) contains a standard specifying that an elk effective cover analysis will be conducted (based on the 1982 Elk Logging Study Annual Report) and a rating of at least 70 will be maintained during the general hunting season (referred to as the Habitat Effectiveness Index or HEI standard). Over time, there has been considerable variability in the way this standard has been applied and how the model has been calculated. Additionally, numerous unforeseen problems have surfaced with the HEI standard. For example, the data used to generate the HEI model were collected outside of the hunting season, and the validity of using it during the hunting season is questionable. Application of the standard during only the hunting season did not alleviate effects of open roads at other times. Many areas on the Forest would not meet the standard simply due to the number of roads outside of Forest Service jurisdiction, or the amount of primary Forest Service access roads. Following an appeal of a timber sale, the Northern Regional Office interpreted the standard to require the Forest Service to meet the HEI value of 70 for timber sales, even when the baseline condition was less than that and the project improved or did not lower the HEI value. This interpretation of the standard does not match the intent of the original Forest Plan, and has led to site-specific Forest Plan amendments for many timber sale projects. Motorized route density-based models, similar to those used to calculate the HEI value, may still be used to measure impacts of Travel Plan decisions, but because of these problems, the existing Forest Plan standard for HEI is not useful or valid and would be amended out of the Forest Plan during this travel planning process under Alternatives 2 through 7-M.

The Forest Plan contains other relevant direction for management of big game populations. There is a goal to *"provide habitat for viable populations of all indigenous wildlife species and for increasing populations of big game animals"* and a standard stating, *"habitat for deer and elk will be managed to provide for slight increases in populations."* This has largely been accomplished since it was written into the Forest Plan, and is especially true for elk populations that have increased and are now above goals in most areas of the Forest. The alternatives varied by district in how well they met this direction, but in some cases, they were deficient (see the section on direct and indirect effects). Another Forest Plan goal is that *"adequate security cover for elk will be maintained over time by providing hiding cover and road management."* (USDA 1987:II-1, II-4). Again, the alternatives varied by district in how well they met this goal. However, it is important to recognize that this goal was intended to apply to the entire Forest, not to be applied by hunting district.

The Statewide Elk Management Plan provides relevant management direction for elk habitat, although some of its recommendations are outdated and will be revised when the plan is updated in

the near future (T. Lemke, MFWP, personal communication). Summer motorized Alternatives 3 through 7-M would generally be most consistent with recommendations from the plan regarding secure habitat (Youmans 1992:74, 77, 80, 95, 132-133, 135-136) because they provide for increases in that habitat component, while Alternatives 1-2 would not. The alternatives vary considerably by district in how well they facilitate achieving the population and bull:cow ratio goals of the plan.