ISSUE 13: LYNX

Changes from the Draft to the Final EIS

The following is a summary of the changes between the Draft and Final EIS:

- Effects parameters were clarified. The winter use analysis looked at snowmobile closure areas vs. accessible open areas due to some discomfort about the accuracy of accessible open area maps and to better coincide with LCAS conservation measure language. In the process of determining total miles of snowmobile and ski routes, 'shared' routes were checked to ensure that route miles were not counted twice where these uses overlapped. In addition, additional qualitative parameters were considered to evaluate how recreation activities may affect lynx.
- A definition and discussion of designated vs. dispersed winter use was provided.
- Reference is made to the Lynx Biology Review Team Final Report (Claar et al. 2006). Recommendations from the report affected the Travel Plan lynx analysis through modification in baseline lynx habitat modeling and in configuration of LAUs across the Gallatin Forest.
- Reference is made to concurrent efforts focusing on lynx management and recovery. These documents include the revised Conservation Agreement, Lynx Recovery Outline, proposed Federal Register of Critical Habitat Designation, and the Northern Rockies Lynx Amendment.
- Figure 3.13.1 – Gallatin National Forest Lynx Analysis Unit Index was replaced with new figure displaying changed LAU configuration.
- Some tables in the effects section were replaced with revised tables displaying basically the same information with changed LAU configuration.
- New references were added including Olliff et al. 1999, Kolbe 2005, Bunnell et al. 2004, Claar et al. 2006, USDI 2005, USDA and USDI 2005.
- A discussion of lynx movement corridors mapped in 2003 was added.
- Based on the reanalysis of ORD of summer routes within the changed LAU configuration, there are no alternatives that exceed the LCAS programmatic guideline for Forest backcountry roads and trails relative to road density of 2.0 mi/ sq mi guideline for any LAUs.
- Tables displaying quantitative data were revised and the effects discussion for winter use by alternative changed substantially based on the changed LAU configuration. For LAUs that indicate an increase in over-the-snow routes and a corresponding increase in snowmobile closure area, LAUs were further examined to determine if the proposed route was already receiving some level of use, if the route was within or adjacent to lynx habitat, and if the amount, location, and habitat quality of snowmobile closure areas served to consolidate use within the LAU. A new Table 3.13.8, LAUs Compliance with LCAS by Alternative (Yes and No), was added to indicate which LAUs would be in compliance with the LCAS.
- A new Table 3.13.9, Alternatives with increase of over-the-snow routes and acres of snowmobile area closure above baseline, was added to take a Forest-wide look at the effect of the Alternative route and area configuration across all LAUs and display alternative compliance with LCAS.

- Table 3.13.10 Relationship of proposed alternatives to applicable conservation measures was modified to reflect revised analysis.
- The cumulative effects discussion was expanded based on the General Description of Other Activities and Programs report compiled by Christiansen, 2006. A summary is provided in this report with a detailed description of effects of other programs and activities in the project file (Feigley, 3/10/06).
- The programmatic direction discussion was modified to address Alternative 7-M proposed programmatic language direction.

Statement of the Issue

The effects to lynx has been identified as an issue as it relates to the existing transportation plan and proposed Travel Plan alternatives. Research suggests that the presence of roads can negatively affect lynx and lynx habitat, directly and indirectly.

Lynx are a prey specialist, largely dependent on snowshoe hares, and usually occur in the habitats where snowshoe hares are most abundant (Claar et al. 1999). Lynx are specially adapted to survival in deep soft snow regions, such as the higher elevations in the northern Rocky Mountains. Physical adaptations to deep snow give lynx a competitive advantage over other predators, which includes the coyote, bobcat, and cougar. Outside of deep snow areas, these generalist predators are believed to exclude lynx through effective competition for food resources. There is a concern that compacted snow routes allow these other predators access up into areas that are normally the exclusive winter range of the lynx.

Directions for evaluating federal actions relative to lynx habitat are provided in the Canada Lynx Conservation Assessment and Strategy (LCAS) (Ruediger et al. 2000). A Forest-wide lynx habitat analysis conducted in 2000 designated Lynx Analysis Units (LAUs), which are intended to provide the appropriate scale to begin evaluation of the effects of management actions on lynx habitat. The configuration of LAUs was modified in 2005 based on recommendations from the Lynx Biology Team (Claar et al. 2006).

Affected Environment

Introduction

The Endangered Species Act of 1973, as amended, requires all federal agencies to review any project authorized, funded or carried out to determine the action is not likely to jeopardize the continued existence of any proposed, threatened or endangered species. Forest Service policy requires that all Forest Service programs and activities need to be reviewed for possible effects on proposed, threatened or endangered species (FSM 2672.4). The Canada lynx was listed as a threatened species under the Endangered Species Act in March 2000. Lynx have been documented, historically and currently, throughout the Rocky Mountains of Montana from the Canadian border through the Yellowstone area. Lynx generally occur in moist subalpine fir habitats, above the dry ponderosa pine and Douglas fir habitat types, and below the alpine zones. Primary lynx habitat in Montana east of the Continental Divide consists of subalpine fir forests as the primary vegetation,

intermixed Engelmann spruce and lodgepole pine. On the east side of the Continental Divide, elevation ranges of subalpine fir forests range from 5,500 to 8,000 feet (Ruediger et al. 2000, Claar et al. 1999).

Description of Population and Habitat Status

Lynx habitat can be generally described as boreal forests that have cold winters with deep snow and that provide a snowshoe hare prey base (USDI 2003). Most lynx occurrences in the western United States are associated with Rocky Mountain conifer forest. Primary vegetation that contributes to lynx habitat is lodgepole pine, subalpine fir and Engelmann spruce. Secondary vegetation, that when interspersed within subalpine forests may also contribute to lynx habitat, includes cool, moist Douglas fir and aspen forests. Dry forest types (e.g., ponderosa pine, climax lodgepole pine) do not provide lynx habitat. According to the U.S. Fish and Wildlife Service (FWS) (USDI 2003), lynx populations are sustained by cyclic influx from lynx populations in Canada.

Lynx need mature forest with a dense understory cover from large woody debris and saplings for denning (Claar et al. 1999). Mature conifer forest with thick deadfall provides denning sites, security, and thermal cover for kittens. The integral component for all lynx den sites appears to be the amount of downed, woody debris present, not the age of the forest stand (USDI 2003). Early successional forests provide the best foraging habitat (Koehler and Brittell 1990) although denning habitat with dead and down material and structural layers composed of seedlings and saplings also provide foraging habitat. In general, habitats that favor snowshoe hare will provide optimal foraging habitat. Generally, earlier successional forest stages have greater understory structure than do mature forests and, therefore, support higher hare densities (USDI 2003).

Snowshoe hares are the primary prey of lynx and lynx distribution is nearly the same as that of snowshoe hare (USDI 2003). Lynx diets as determined from a study in north central Washington consisted of 79% snowshoe hares and 24% red squirrels (Koehler 1988). Preferred lynx foraging habitat consists of dense conifer seedling and sapling stands that provide snowshoe hare browse and escape and thermal cover (Koehler 1990). Most research has focused on the winter diet, and diets in the summer are poorly understood throughout the range. However, indications are that the summer diet may include a greater diversity of prey species. Lynx are able to subsist on jackrabbits and other mid-sized prey in foothills and drier montane environments where competition from bobcats is not overbearing. During the cycle when hares become scarce, the proportion and importance of other prey species, especially red squirrel, increases in the diet. However, Koehler (1990) suggested that a diet of red squirrels alone might not be adequate to ensure lynx reproduction and survival of kittens. A shift to alternate food sources may not sufficiently compensate for the decrease in hares consumed to be adequate for lynx reproduction and kitten survival (USDI 2003).

As a solitary, wide-ranging predator, lynx maintain low population densities and are vulnerable to cyclic prey densities. Koehler (1988) and the US Fish and Wildlife Service (USDI 2003) suggest that the scarcity of prey (naturally lower densities of snowshoe hare), may account for the low density and low productivity of lynx in the southern part of lynx range. Similarly, home range size varies with dispersion pattern of suitable habitat and with the abundance of prey as a response to lower density snowshoe hare populations. Males generally maintain larger home ranges than females. In Montana, Brainerd (1985) reports home range sizes of about 17 and 122 sq mi for

females and males respectively. Nellis (1989) indicates that most home ranges fell between 5-20 sq mi. Ruediger et al. (2000) found annual home range size for females averaged 44 sq mi.

Species Occurrence

The US Fish and Wildlife Service (USDI 2003) describes a scenario wherein lynx range coincides with that of the southern margins of boreal forest where it is naturally fragmented into patches of varying size as it transitions into subalpine forest. Where boreal forest patches within the contiguous United States are large, with suitable habitat, prey, and snow conditions, resident populations of lynx are able to survive throughout the cyclic snowshoe hare populations. When there is a high in the lynx metapopulation in Canada, dispersion of individuals act like a wave radiating out to the margins of the lynx range. Lynx are able to disperse long distances, crossing unsuitable habitats, in order to colonize suitable habitats and find potential mates.

The US Fish and Wildlife Service partially bases their conclusions regarding whether lynx in a particular area are resident or dispersers on the record of reliable reports of lynx, of which the best information available on historic lynx presence is trapping data. McKelvey et al. (1999) looked at the historical distribution of lynx from the 1880s to the present. They found evidence of lynx from museum specimens collected in 1887 and reliable trapping data obtained from the Montana Department of Fish, Wildlife, and Parks (MDFWP) beginning in 1950. These data show continuous presence of lynx in Montana. The dynamics of the trapping data appear to be associated with patterns of lagged synchrony; peak harvest data correspond in time and magnitude with a two-year lag time between Montana and southwestern Canada. They concluded that lynx trapped in the twentieth century could have been produced by a local population, or be mostly immigrants or any combination of local lynx and dispersers. In summary, the range of lynx in the contiguous United States is comprised of areas supporting resident, breeding populations and areas supporting occasional dispersers. Specifically, in southwestern Montana where naturally occurring patchy and drier forest types make habitat more marginal, dispersers are supported more than resident populations. It is unclear at this time what role the Gallatin Forest and adjacent Yellowstone National Park play in the long-term survival of lynx. However, the Recovery Outline (USDI 2005) roughly identifies the Gallatin National Forest serving as ‘core’ or ‘secondary’ areas, which further implies the present or historic presence of lynx and the potential role of the Gallatin Forest in lynx recovery.

With this in mind, lynx are considered a potential and confirmed resident of occupied habitat on the Gallatin Forest. Lynx have been trapped here as recently as 1997 on the Gallatin National Forest (Giddings, personal communication). Trapping records beginning in 1978 indicate that approximately 20 individual lynx were legally trapped before MDFWP’s change in trapping regulations in the winter of 2000-2001 to exclude the capture of lynx. No incidental take of lynx has been reported since the closure. Lynx observation data from the Montana Natural Heritage Program (MNHP 2004) database include 20 observations or tracks, some of which are duplicates of the trapping record. Snow track surveys and DNA analysis have confirmed lynx presence in the Absaroka Mountains. In addition, a three-year lynx hair snare survey, following the National Lynx Detection Protocol (McKelvey 1999) began in 2002; two of the genetically analyzed collected hair samples were identified as lynx. Murphy et al. (2004) also report the presence of lynx verified by DNA analysis in Yellowstone National Park, including offspring. They suggest that, though limited

to distribution, the species persists at low densities and that population persistence may be provided by reproduction of resident females.

Analysis Methodology

The LCAS (Ruediger et al. 2000) is the primary basis for determining effects to lynx. There are no specific methodologies for determining effects to lynx other than guidelines and standards identified in the LCAS. A Conservation Agreement between the US Forest Service and the US Fish and Wildlife Service committed the Forest Service to consider recommendations in the LCAS when determining the effects of actions on lynx until the Forest Plans are amended (USDI 2003, USDA and USDI 2005). To address compliance with the Conservation Agreement and the LCAS habitat standards, effects to Canada lynx were evaluated by assessing the travel planning proposal and alternative(s) subsequent effects to those guidelines and standards that apply to these specific actions. Standards and guidelines were developed based on risk factors and credible scientific evidence. Those risk factors are described in Chapter 2 of the LCAS. Those that apply to the travel planning alternatives include those factors affecting lynx productivity (recreation, Forest/ backcountry roads and trails), factors affecting lynx mortality (legal and non-target trapping, incidental or illegal shooting, competition and predation as influenced by human activities), and other large-scale risk factors (lynx movement and dispersal across shrub-steppe habitats).

As stated above, direction for habitat management for lynx is found in the LCAS (Ruediger et al. 2000), which outlines guidelines and standards at the programmatic and project level of planning. The proportion of unsuitable lynx habitat and lynx denning (and foraging) habitat would not be changed with any of the travel planning alternatives as no vegetation treatment is proposed. In regards to travel management, key information is found in Conservation Measures, Chapter 7 in two sections (pages 7-8 to 7-10); Recreation Management and Forest/Backcountry Roads and Trails. Most objectives, standards and guidelines in these two sections are aimed at addressing areas of primary concern. One concern relates to landscape scale connectivity of lynx habitat. This is a basic habitat characteristic that is important to the conservation of many species, including many wide-ranging mid-size and larger carnivores. Another habitat concern is unique to lynx and revolves around potential competing predators who may utilize packed snow routes for access into areas normally only accessible to lynx. The standards and guidelines incorporate recommendations on location and use of public roads and motorized trails, particularly during periods of winter use. Table 3.13.1 through Table 3.13.3 below outline the conservation measures applicable to the Travel Plan alternatives and pertinent discussion relative to those conservation measures.

Table 3.13. 1 Conservation measures applicable to all programs and activities.

Programmatic Planning (7-3)	
Standards	**Discussion**
S1 - Conservation measures will generally apply only to lynx habitat on federal lands within LAUs.	Standards were only measured against existing conditions on federal lands in lynx habitat for direct and indirect effects with three exceptions: 1) summer motorized routes and over-the-snow routes were measured in total even if they transverse private lands; 2) areas of non-habitat were included in calculations of snowmobile restriction area changes on National Forest; and 3) private lands within the LAUs were qualitatively discussed in the cumulative effects section.
S2 - Lynx habitat will be mapped using criteria specific to each geographic area to identify appropriate vegetation and environmental conditions.	In compliance with LCAS Project Planning Standards regarding habitat delineation, a map identifying primary lynx habitat is located in the electronic files in the Gallatin GIS library.
S3 - To facilitate project planning, delineate LAUs; LAUs should be at least the size of area used by a resident lynx and contain sufficient year-round habitat.	See section below on LAUs on the Gallatin National Forest.
S4 - LAU boundaries will not be adjusted for individual projects, but must remain constant.	See section below on LAUs on the Gallatin National Forest.
S5 - Limit disturbance within each LAU: if more than 30% of lynx habitat within a LAU is currently in unsuitable condition, no further reduction of suitable conditions shall occur as a result of vegetation management by Federal agencies.	Baseline habitat standards will not be analyzed in detail by alternative. The proportion of unsuitable lynx habitat would not be changed with any of the travel planning alternatives as no vegetation treatment is proposed.
Project Planning (7-4)	
Standards	**Discussion**
S1 - Within each LAU, map lynx habitat; identify potential denning and foraging habitat (hares, squirrels, etc.), and topographic features important for lynx movement (major ridge systems, prominent saddles, and riparian corridors); identify non-forest vegetation (meadows, shrublands, grasslands, etc.) adjacent to and intermixed with forested lynx habitat providing habitat for alternate lynx prey species.	*Not applicable for this analysis at programmatic level.* Primary lynx habitat is located in the electronic files in the Gallatin GIS library. Willow, aspen, and sagebrush habitats adjacent to conifer habitats mapped as lynx habitat have also been identified as secondary habitat. *Further NEPA analysis would be required for implementation of the selected travel plan alternative.*
S3 - Maintain habitat connectivity within and between LAUs.	It is essential that landscape connectivity between lynx habitats and populations in Canada and the contiguous United States be maintained (USDI 2003).

Table 3.13. 2 Conservation measures to address risk factors affecting lynx productivity.

Recreation Management (7-9) - Programmatic Level	
Standards and Guidelines	**Discussion**
S1 - On federal lands in lynx habitat, allow no net increase in groomed or designated over-the-snow routes and designated snowmobile play areas by LAU unless the designation serves to consolidate unregulated use and improves lynx habitat though a net reduction of compacted snow area (Ruediger et al. 2000, Mcallister 2003).	This standard was developed to meet the programmatic planning objective listed under Recreation Management (LCAS:7-8, Ruediger et al. 2000): "plan for and manage recreational activities to protect the integrity of lynx habitat." The focus is to minimize snow compaction in lynx habitat.
S2 - Map and monitor the location and intensity of snow compacting activities… that coincide with lynx habitat, to facilitate future evaluation of effects on lynx as information becomes available.	This analysis considered known over-the-snow winter recreation and identified those areas of lynx habitat accessible with over-the-snow winter recreation as it related to LCAS standards and guidelines.
G1 - Provide a landscape with interconnecting blocks of foraging habitat where snowmobile, cross-country skiing, snowshoeing, and other snow compacting activities are minimized or discouraged.	*Not applicable for this analysis* –Foraging habitat is well distributed across the Forest and generally precludes over-the-snow activities. In addition, over-the-snow activities are limited due to wilderness designation, topography, accessibility, or other restrictions.
G2 - As information becomes available on the impact of snow-compacting activities and disturbance on lynx, limit or discourage this use in areas where it is shown to compromise lynx habitat.	Existing and ongoing literature and research was used to conduct analysis.

Forest/Backcountry Roads and Trails (7-10) – Programmatic Level	
Standards and Guidelines	**Discussion**
S1 - On federal lands in lynx habitat, allow no net increase in groomed or designated over-the-snow routes and snowmobile play areas by LAU. (This standard is similar to S1 – Recreation Management.)	Plowed roads and groomed over-the-snow routes may allow competing carnivores such as coyotes and mountain lions to access lynx habitat in the winter, increasing competition for prey (Ruediger et al. 2000).
G1 - Determine where high total road densities (>2 miles per square mile) coincide with lynx habitat, and prioritize roads for seasonal restrictions or reclamation in those areas.	Further research directed at elucidating the effects of road density on lynx is needed (Ruediger et al. 2000).
G2 - Minimize roadside brushing in order to provide snowshoe hare habitat.	*Not applicable for this analysis* but may be an indirect effect of implementation of the selected travel plan alternative if it includes reconstruction, rerouting, etc. of selected roads and/or trail routes *for which further NEPA analysis would be required*.
G3 - Locate trails and roads away from forested stringers.	*Not applicable for this analysis.* See G2. Landscape connectivity may be provided by narrow forested mountain ridges, plateaus, or forest stringers that link more extensive areas of lynx habitat (Ruediger et al. 2000).
G5 - Minimize building of roads directly on ridgetops or areas identified as important for lynx habitat connectivity.	

Table 3.13. 3 Conservation measures to address mortality risk factors; movement/dispersal.

Mortality Risk Factors - Programmatic Level Standards and Guidelines (LCAS, 7-12 to 16)	
Trapping (7-12)	Discussion
G1 - Federal agencies should work cooperatively with States and Tribes to reduce incidental take of lynx related to trapping.	Lynx are known to be vulnerable to trapping. Lynx may be more vulnerable to trapping near open roads (Ruediger et al. 2000).
Shooting (7-12)	Discussion
G1 - Initiate interagency information and education efforts throughout the range of lynx in the contiguous states. Utilize trailhead posters, magazine articles, news releases state hunting and trapping regulation booklets, etc., to inform the public of the possible presence of lynx, field identification, and their status.	Lynx may be mistakenly shot by legal predator hunters seeking bobcats, or illegally by poachers. Prey species may also be affected by legal shooting (Ruediger et al. 2000).
Competition and Predation as Influenced by Human Activities (7-13)	Discussion
S1 - On federal lands in lynx habitat, allow no net increase in groomed or designated over-the-snow routes and designated snowmobile play areas by LAU unless the designation serves to consolidate unregulated use and improves lynx habitat though a net reduction of compacted snow area.	Habitat changes that benefit competitor/ predator species, including providing packed snow travel ways, may lead to increased starvation or direct mortality of lynx (Ruediger et al. 2000).
Movement and Dispersal - Programmatic Level Standards and Guidelines (LCAS, 7-12 to 16)	
Highways (7-14)	Discussion
G1 - Dirt and gravel roads traversing lynx habitat (particularly those that could become highways) should not be paved or otherwise upgraded … in a manner that is likely to lead to significant increases in traffic volumes, traffic speeds, increased width of the cleared ROW, or would foreseeably contribute to development or increases in human activity in lynx habitat.	Highways impact lynx by fragmenting habitat and impeding movements. Special concern must be given to the development of new highways including gravel roads being paved (Ruediger et al. 2000).

Effects Parameters

Lynx habitat components i.e., temporary unsuitable, denning, and foraging, would remain constant among all the alternatives. Therefore, only the standards and guidelines relative to recreation and road management outlined above apply, specifically as they relate to winter and summer motorized use activity, and habitat connectivity, and will be used to analyze the proposed travel plan alternatives. Parameters used to measure effects include summer motorized open road density (ORD), miles of marked or groomed (i.e., designated) over-the-snow (snowmobile and ski) routes, and acres of closed snowmobile area.

The LCAS states that conservation measures generally apply only to lynx habitat within the LAUs. However, roads used to analyze summer motorized ORD include all public and private roads and motorized trails (including closed roads open to ATVs), except project roads, which are defined in the proposed Gallatin National Forest Travel Management Plan and Forest Plan Amendment Starting Benchmark. The area used to calculate open road density (ORD) is the gross acres (public plus private) within each LAU. This ORD value will be measured against the >2.0-mi/sq mi programmatic guideline for Forest/Backcountry Roads and Trails (G1).

Snowmobile and ski routes include total of public miles by LAU that would be marked or groomed, i.e., designated, by alternative. For the purposes of this analysis, "designated" will be defined as over-the-snow routes that are (or potentially will be based on the selected alternative) specifically marked on a map, described in the travel plan, or signed on the ground as per the LCAS - Clarifications and Revised Terminology approved glossary definition (Lynx/ Wolverine Steering Committee 2001). Over-the-snow routes determined through this travel planning effort would be signed and indicated on a visitor recreation map.

Conversely, and for the purposes of this analysis, winter "dispersed" use may be defined as recreation activity that occurs off of designated routes (which would be allowed during winter travel only where not otherwise restricted) and that occurs outside of developed areas that support concentrated use. There is an unknown amount of dispersed snowmobile and ski use that is not measured in this analysis. Most of this dispersed over-the-snow use may be accounted for in the calculation of over-the-snow area open (or closed) to snowmobiles although these areas are not closed to skiers. Snowmobile over-the-snow area is calculated as number of acres legally open within the National Forest acres portion of each LAU including non-habitat. The baseline from which to determine an increase or decrease in snowmobile and ski routes and areas will be the existing Gallatin Forest Travel Plan or Alternative 1 (Dixon 2004). Additional qualitative parameters considered to evaluate how recreation activities may affect lynx include type and quality of lynx habitat in which activity occurs, time of year and day activity occurs, type and pattern of activity, and intensity and frequency of activity (Ruediger et al. 2000).

These identified parameters will be discussed by LAU and alternative with some discussion pertinent to individual Travel Planning Areas (TPAs) when LAUs appear to approach or exceed standards. Additional qualitative discussion may be needed at the Gallatin Forest level. Private lands within individual LAUs will be discussed in cumulative effects. For effects parameters of summer motorized ORD, open over-the-snow designated routes, and closed snowmobile areas, the number displayed to determine compliance with LCAS standards and guidelines will err conservatively, favoring the lynx, due to the inclusion of segments of routes and areas that bisect or overlap non-habitat but may be receiving some level of use. The data still provides a relative comparison by alternative and also provides some level of assessment of the habitat connectivity Project Planning Standard (S3).

Lynx Analysis Units (LAU) on the Gallatin National Forest

As part of the requirements of the LCAS, LAUs were mapped for the Gallatin National Forest in 2000. Approximately 25% of all LAUs did not meet the guideline for size and amount of lynx habitat within each LAU. Lynx Analysis Units (LAUs) were reviewed by the Lynx Biology Review Team and, based on their recommendations, LAUs were reconfigured in 2005. See the project file (Claar et al. 2006) for more information.

LAUs should generally be 16,000 to 25,000 acres in contiguous habitat and likely should be larger in less contiguous, poorer quality, or naturally fragmented habitat. Programmatic guidelines suggest, "at least 10 sq mi of primary vegetation should be present within each LAU to support survival and reproduction" (Programmatic Planning Guideline:7-4). LAUs should approximate the size of a female's home range and encompass all seasonal habitats (Ruediger et al. 2000). LAUs on

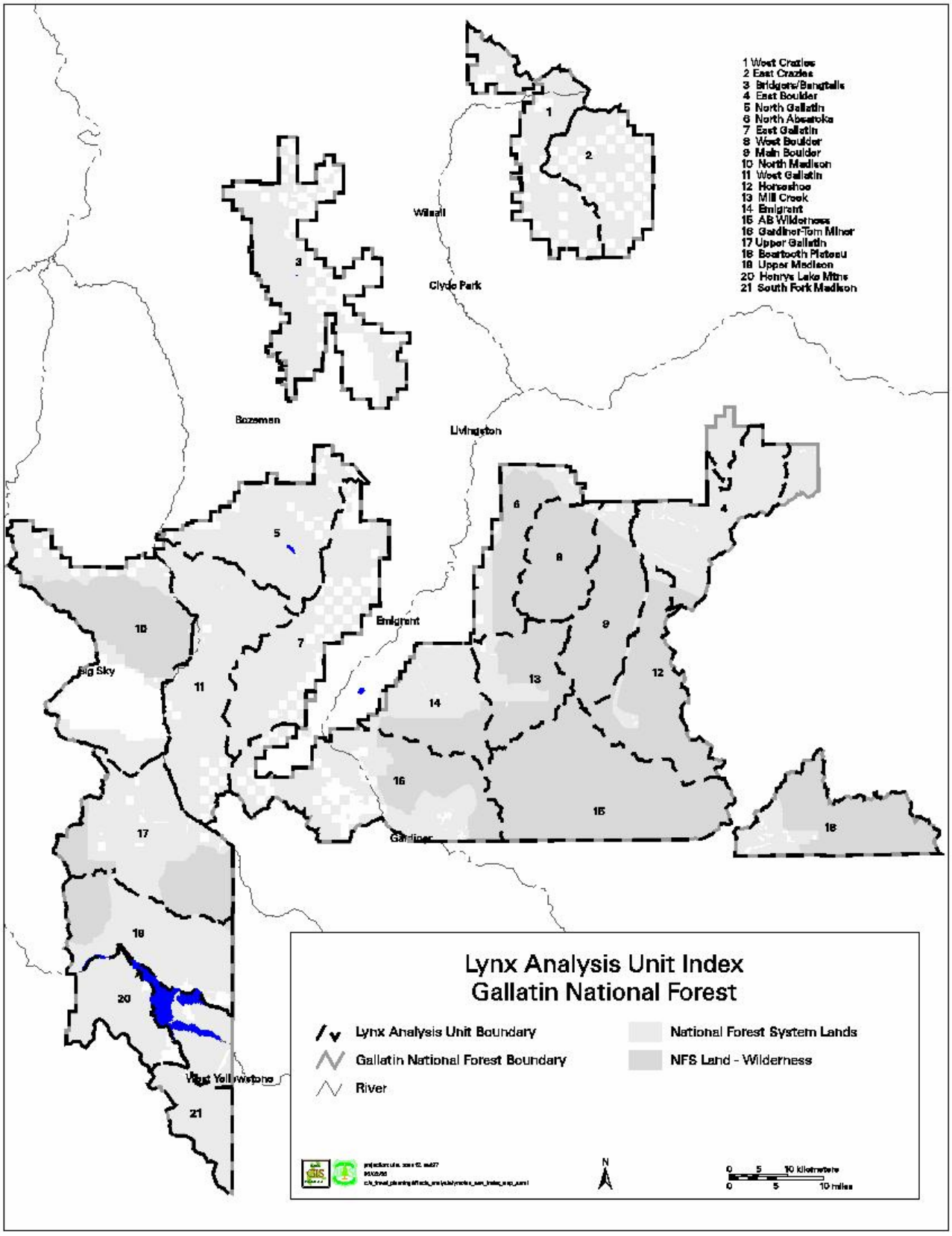
the Gallatin National Forest vary in size from 38,738 to 160,039 acres. Some LAUs include a majority of designated Wilderness acreage at elevations and in habitat types that do not constitute lynx habitat. Other LAUs possess lynx habitat in a patchy juxtaposition which may be marginal in its ability to provide lynx with habitat components essential for their adaptations due to the amount of adjacent non-habitat or private land. However, these LAUs could potentially still be used as traveling habitat by dispersing lynx. See Figure 3.13.1 that displays the LAUs on the Gallatin Forest.

Table 3.13.4 (below) displays all the LAUs by Travel Plan Areas on the Gallatin National Forest, ORD, miles of snowmobile and ski route, and acres closed to snowmobiles for Alternative 1 or existing condition. The snowmobile and ski route column includes all groomed and/or marked routes, which are proposed as an emphasized use. The closed snowmobile area is that area where dispersed use by snowmobiles may not occur off of designated groomed and/or marked trails. This will serve as a baseline from which to compare the Travel Plan alternatives relative to the change in snow compacted routes and areas. It will also serve as a point from which net increases and potential compensatory decreases in snowmobile area can be analyzed and discussed. Net National Forest acreages are displayed because the LCAS states *"Conservation measures will generally apply only to lynx habitat on federal lands within LAUs"* (Programmatic Planning Standard:7-3). All LAUs contain at least 10 sq mi (6,400 acres) of primary lynx habitat.

Table 3.13. 4 Gallatin Forest LAUs: summer ORD, winter miles/ acres, Alternative 1.

LAU	Total LAU Acres (FS acres only)	Acres of Lynx Habitat w/in LAU	Summer Open Road Density (mi/sq mi)	Miles of Snowmobile plus Ski Route	Snowmobile Area CLOSED (acres of LAU)
AB Wilderness	160,039	89,516	0.0	0	0
Beartooth Plateau	81,935	17,660	0.3	40	0
Bridger/Bangtails	88,786	32,518	1.9	66	4,729
East Boulder	84,764	27,973	0.9	13	0
East Crazies	47,096	19,948	0.6	0	0
East Gallatin	90,151	44,239	1.5	5	21,200
Emigrant	70,592	23,875	0.4	2	11,005
Gardiner-Tom Miner	127,408	48,088	0.8	21	31,709
Henry's Lake Mtns	48,161	29,716	1.2	5	24,725
Horseshoe	84,020	27,392	0.0	15	0
Main Boulder	72,669	26,224	0.1	6	0
Mill Creek	63,170	26,928	0.6	20	0
North Absaroka	59,673	30,608	0.2	2	1,683
North Gallatin	89,941	62,464	1.4	82	31,439
North Madison	118,727	69,649	1.1	37	452
South Fork Madison	38,738	34,158	1.6	66	4,676
Upper Gallatin	120,670	58,749	0.5	14	19,083
Upper Madison	93,028	51,328	0.6	31	5,499
West Boulder	56,236	24,535	0.1	0	0
West Crazies	68,378	44,029	1.4	23	0
West Gallatin	122,539	72,539	1.1	87	22,354
TOTAL	1,786,721	862,136	0.8	535	178,554

Figure 3.13.1 – Gallatin National Forest Lynx Analysis Unit Index



Direct and Indirect Effects

Effects Common to all Alternatives

This section addresses the potential effects that the Travel Plan alternatives may have on lynx and lynx habitat. The presence of roads and trails can directly and indirectly affect lynx and lynx habitat. Directly, road or trail building through lynx habitat can reduce the total amount of habitat available and pose a threat to mortality from vehicles. Indirectly, the impacts of roads include increased access for both legal and illegal hunters and trappers, decrease in prey habitat, increased access during winter for competing carnivores, and disruption of lynx travel and hunting patterns, and potential avoidance of human activity areas (Koehler and Brittell 1990, Brittell et al. 1989).

Direct Effects

The mere presence of roads represents a direct loss of habitat. Generally speaking, lynx habitat and grass/shrubland or riparian habitat serving as interconnected blocks between lynx habitat would improve with the implementation of Alternatives 2 through 7-M, due to the restriction of travel to designated routes and subsequent reduction in road and trail density. No vegetation treatment is proposed with this analysis and the habitat components of denning and foraging will not change. Any ground disturbing activities resulting from implementation of a selected Travel Plan alternative would require subsequent additional environmental analysis (e.g. for trail relocation); proposed travel plan alternatives would not result in final agency action to build roads or trails. Therefore, the direct effects of loss of habitat will not be discussed further. Refer also to Issue 9: General Wildlife.

Indirect Effects

Summer Motorized Use

The likelihood of lynx encountering people has dramatically increased over the last few decades because of elevated levels of human access into lynx habitat. Roads and trails, snowmobiles, off-road vehicles, and ski area developments enable human access into historically remote forests, thereby increasing the likelihood of lynx being displaced from otherwise suitable habitats and increasing the vulnerability of lynx to human-induced mortality. Roads constructed for forest management, mining or recreational purposes may increase the vulnerability of lynx to hunters and illegal trappers (Koehler and Aubry 1994).

Elevated levels of human access into forests are a threat to Canada lynx because they increase the likelihood of lynx encountering people, which may result in displacement of lynx from their habitats and/or possible injuries or deaths by intentional or unintentional shooting, illegal or non-target trapping and vehicle accidents (Brittell et al. 1989, Koehler and Brittell 1990, Olliff et al. 1999). Roads into areas occupied by lynx may pose a threat to lynx from incidental harvest or poaching (Koehler and Brittell 1990) and disturbance or mortality from vehicles (Aubry et al. 1999). Disturbance, as it might relate to displacement effect from either motorized or non-motorized human presence, is generally not an issue. However, Olliff et al. (1999) stated that

human disturbance causes lynx to avoid habitats that are otherwise suitable and may preclude lynx from using habitat in an optimal manner. Lynx seem to not avoid roads except at high traffic volumes. However, summer use of roads and trails through denning habitat may affect lynx if kittens are moved due to associated human disturbance (Ruediger et al. 2000).

Lynx avoid open areas and use mature forest or forest with dense cover, tall shrubs, and well-vegetated riparian areas as travel corridors. Corridors may include tops of ridges and riparian zones where subalpine fir, lodgepole pine, and spruce provide greater than 30 percent canopy cover (Olliff et al. 1999). Lynx will use some types of roads for hunting and travel down old roads <50 feet wide with good cover along both edges (Koehler and Brittell 1990) and cross openings <100 meters (approximately 300 feet) in width (Koehler and Aubry 1994). However, roads may disrupt lynx travel and hunting patterns. Koehler and Aubry (1994) concluded road construction and maintenance are important components of lynx habitat management because they both destroy and create prey habitat, but also make lynx more vulnerable to human-caused mortalities.

Brittell et al. (1989) recommend that roads be maintained to a minimum possible standard to discourage heavy public use disturbance. Koehler and Brittell (1990) also recommend that roads should be maintained to primitive standards to mitigate effects to lynx. As lynx do travel along roads with <50 feet right-of-way, they also recommend that vegetation growing along the edge of the road be maintained as cover for lynx and browse for snowshoe hare. There are no recommended thresholds for lynx in the literature in terms of open road density; however, roads may pose a risk (illegal or non-target trapping, accidental vehicle death, or illegal shooting) to the reproduction and/or survival of lynx within a particular home range. The LCAS provides a programmatic guideline for Forest backcountry roads and trails relative to road density at 2 mi/sq mi. In a recently published Federal Register (USDI 2003) that addressed potential threats to lynx, the US Fish and Wildlife Service concluded that the threat to lynx populations from high traffic volume on roads that bisect suitable lynx habitat is low.

Winter Routes

Based on knowledge of lynx natural history, the winter season is most critical due to scarce prey base and breeding biology needs. Changes in winter access affect vulnerability of this species to illegal or non-target trapping as well as their ability to capitalize on the habitat niche for which they are adapted (deep snow, high elevations, moist habitat types). To be considered lynx habitat, an area must have the potential to sustain a lynx population over a period of time, which includes supporting the appropriate vegetation composition and structure to support adequate snowshoe hare densities and deep snow where lynx are at a competitive advantage (USDI 2003).

Deep, low-density snow allows lynx to exploit higher elevation areas during winter that typically exclude competitors such as coyotes, bobcats, and mountain lions (Claar et al. 1999). These potential competitors cannot compete under deep, low-density snow conditions because of the physical anatomy of the size of their body and feet. They have considerably higher foot loading values relative to the ratio of the *body: paw* size thus giving them a lower support capacity and requiring a greater energy exertion to traverse snow. Although their diets may overlap, differences in habitat selection may minimize competition for prey resources (hares) between lynx and other predators, especially during winter. However, opportunities for resource overlap and increased

competition for prey among these species may increase during winter due to increased access from plowed roads and snowmobile trails that are maintained for winter recreation, enabling coyotes and bobcats to access lynx winter habitat (Koehler and Aubry 1994).

According to Claar et al. (1999), Ruediger et al. (2000), Kolbe (2005), and Bunnell et al. (2004), packed trails created by winter use activities may negatively impact lynx populations through interference and/ or exploitation competition. Availability of compacted snowmobile trails may provide other predators, especially coyotes, access to lynx habitat during annual periods of deep snow that facilitates competition for primary prey (snowshoe hare) predation opportunities or by directly killing lynx. The subsequent decrease in snowshoe hare numbers available to lynx may negatively affect lynx distribution and abundance (Kolbe 2005). For the purposes of this analysis, there is no differentiation between snowmobile routes or ski routes relative to the effect of snow compaction on lynx or lynx prey. However, it is somewhat intuitive that snowmobiles produce greater compaction than skis. While both skiing and snowmobiling result in snow compaction, the density and extent of compaction on trails that can only be created by snowmobiles may affect predator communities (Kolbe 2005).

Bunnell et al. (2004) completed research in Utah that supports the hypothesis that trails compacted by winter recreational use does break down the spatial segregation of lynx and coyote and facilitates coyotes' exploitation of areas of deeper snow. The results suggest that coyotes need the presence of a packed trail but also persistence of packed trails, i.e. the spatial arrangement of snowmobile trails and consistency of use providing a reliable source of packed trails (groomed or ungroomed) are factors that may determine coyote impacts on lynx. He suggested that their research findings of coyote use on snowmobile trails added legitimacy to management steps taken to reduce the potential impacts of coyotes on lynx conservation. However, this study area did not detect the presence of lynx so conclusions were based on potential impacts to lynx habitat, used as a surrogate, when looking at coyote access to areas of during deep snow conditions. Additional research needs were noted to look at the simultaneous evaluation of sympatric coyote and lynx populations to identify and quantify the actual extent of exploitation and interference competition. However, Kolbe (2005) looked at the degree of sympatry between lynx and coyote during deep snow winter conditions, coyote behavior on compacted snowmobile trails, and coyote winter food habits near Seeley Lake, Montana. He indicated that coyotes were consistently present in deep snow areas used by lynx and his research suggests that although coyotes use packed snow corridors more than expected, the majority of coyote travel distance is on non-compacted snow. While there was no selection for compacted over non-compacted road surfaces, he found that coyotes did select for shallower and more supportive snow conditions where they naturally occurred in forested stands. Coyotes did not appear to use compacted snowmobile trails to locate or acquire food on the study area and there was only three snowshoe hare kills out of eighty-eight feed sites. Kolbe (2005) concluded that the influence of snowmobile trails on coyote movements and foraging success during winter appeared to be minimal.

Despite current research, there continues to be no solid, consistent data on the role of competition between lynx and other species. In a recently published Federal Register (USDI 2003) that addressed potential threats to lynx, the US Fish and Wildlife Service concluded: 1) There is no evidence that any competition that may exist between lynx and other species exerts a population-level impact on lynx and 2) No evidence has been provided that packed snow trails facilitate

competition to a level that negatively affects lynx. Neither factor is considered a threat to lynx populations, but possibly to individuals.

Lack of research on the magnitude of disturbance or displacement of lynx by winter recreation activities makes it difficult to assess the effect. Both snowmobiling and cross country skiing tends to occur in or adjacent to lynx habitat and both require some level of infrastructure development, such as road plowing or grooming, that concentrates use in those areas and may reduce the effectiveness of lynx habitat (Olliff 1999). Generally, snowmobile routes are also wider, especially if groomed, and produce noise that can carry long distances depending on the terrain. However, lynx will tolerate moderate levels of snowmobile traffic through their home ranges Mowat et al. (1999) and may show some habituation to snowmobile activity where it is temporally and spatially consistent (Olliff et al. 1999). If non-motorized winter recreation activities are not on a groomed or marked trail that receives consistent use, they may potentially affect lynx more than motorized uses due to the dispersed and unpredictable activity (Olliff 1999). These activities may cause lynx to expend energy beyond their caloric intake, decreasing natality and increasing mortality (Olliff 1999).

Winter snow tracking found that road edges and trails are often followed by lynx for considerable distances, particularly roads less than 15 m wide (Aubry et al. 1999). However, increasing human access into Canada lynx habitat has increased the vulnerability of Canada lynx to both legal and illegal harvest in areas that, historically, were relatively isolated from humans (Todd 1985). Lynx are particularly vulnerable to exploitation by trapping (Bailey et al. 1986); they are relatively easy to capture, appear to have little fear of human scent, respond to baits and lures, and can be attracted by visual attractants (Mowat et al. 1999). Therefore, illegal or non-target trapping can be a significant source of mortality for lynx and can depress populations where exploitation is intense and recruitment is low.

Currently, MDFWP has closed the trapping season for lynx. Accidentally trapped and released lynx must be reported within five days of release if uninjured, or immediately if injured. Although travel and harvest restrictions can regulate legal harvest, incidental captures associated with bobcat and coyote trapping in lynx habitat will occur (Hash 1990) and opportunities for the illegal take of lynx will continue or increase (Brittell et al. 1989). However, precautions taken by the State to restrict lynx trapping have likely prevented and continue to prevent the over-harvest of resident lynx (USDI 2003). Giddings (2004) considers the risk of incidental take to be extremely low but cannot predict illegal activity. In a recently published Federal Register (USDI 2003) that addressed potential threats to lynx, the US Fish and Wildlife Service concluded that the threat to lynx populations from illegal harvesting is low, but individuals may be taken.

Habitat Connectivity

Animals move across landscapes to meet daily, seasonal and lifetime needs (Craighead 2002). In the Rocky Mountain/Cascades region, much of lynx habitat is naturally disjunct and habitat connectivity is required across large geographic areas to facilitate dispersal and genetic exchange. Maintenance of habitat quality requires maintenance of linkages, connectedness and interspersion over geographic areas large enough to benefit individuals and join individuals into populations. Activities that fragment, dissect and isolate habitats have undesirable effects on all forest

carnivores. Fragmentation is most frequently caused by human activities including road construction (Lyon et al. 1994). Roads and trails can be over-the-snow routes, which can also contribute to loss of habitat connectivity. Maintaining travel corridors between populations may be important to ensure the long-term viability of peripheral or isolated populations in the western mountains (Koehler and Aubry 1994). In the short-term, restricted movements can have negative impacts on populations and ecosystem function. In the long-term, restricted movements can reduce gene flow and have negative impacts on metapopulations and species (Craighead 2002).

According to Craighead (2002), Koehler (1990) and Koehler and Brittell (1990), when moving between denning and foraging habitats, lynx select areas of high canopy closure and avoid open areas, which may disrupt movement patterns if greater than 100 m in width. Aubry et al. (1999) also assert that paved roads or highways were crossed less than random expectations within home ranges (Apps 1999) and may have an influence on lynx spatial organization and movements. Apps (1999) also suggested that dominant natural and human features (such as terrain and the Trans-Canada Highway) may constrain dispersal options. Conversely, Ruggiero (1999), Squires and Laurion (1999) and Aubry et al. (1999) found that lynx move across fragmented landscapes and have documented lynx movements crossing open valley bottoms and large rivers concluding that these landscape features are not absolute barriers to dispersal.

According to the US Fish and Wildlife Service (USDI 2003), lynx are dispersers where boreal forest is isolated, patchy, or of marginal quality such that it cannot sustain a resident breeding population. Lynx that have attempted what appeared to be dispersal (movement from a place of residence to breeding site) have not been successful in southern boreal forests due to movements cut short when the animal died (trapped). Aubry et al. (1999) documented lynx making exploratory movements where they make long-distance movements beyond their normal home range boundaries and subsequently return. They speculate that the distribution of high quality habitat is patchy and fragmented due to topographic relief and variation in habitat conditions. Therefore, in montane systems with high amounts of spatial heterogeneity, exploratory movements to locate suitable habitat may enhance dispersal success. While successful dispersals can result in the colonization of unoccupied habitats and contribute to the persistence of the metapopulation, only a few areas in the contiguous United States historically supported adequate quality and quantity of habitat to support resident lynx populations over time (USDI 2003).

In a recently published Federal Register, the US Fish and Wildlife Service (USDI 2003) asserts that no information currently exists to determine the level at which traffic volume or roadway design may influence or create an impediment to lynx movement. They addressed potential threats to lynx and concluded that the threat to lynx populations from high traffic volume on roads that bisect suitable lynx habitat and associated suburban developments is low. In addition, they concluded that there is low threat to the contiguous United States lynx population to maintain connectivity between habitats in Canada and the United States. They state their belief that all historic habitats, including boreal forest that exists in patches or is of marginal quality, is still available to dispersing lynx except for areas where development has encroached on the boreal forest or is isolated from source lynx populations. The habitat connectivity considerations, and thus the LCAS direction regarding linkage areas, may also apply at a local scale. As stated above, the area closure and designated route proposal in response to the Montana/Dakota OHV decision common to all action Alternatives 2 through 7-M, would provide some benefit to lynx by concentrating human activity and allowing

areas of seclusion outside of the travel corridors. The travel plan alternatives are most responsive to the Montana/Dakota OHV decision through the summer motorized route proposal. However, winter routes and snowmobile closure areas would also be designated. Brittell (1989) recommends managing travel cover to allow movement of lynx within their large home ranges. Major ridges should be managed for travel cover, with emphasis on saddles and of a width ≥300 ft.

Activities that may impact the lynx and its habitat are typically localized, and even within a local area the impact an activity may have on lynx can vary depending on the quality and quantity of habitat in a local area or the size of the local resident population (USDI 2003).

As part of the implementation of the interagency Canada Lynx Conservation Agreements, lynx linkage areas were identified. These linkage areas are meant to aid in movement and dispersal of individuals separated by areas of non-habitat (McAllister 2003). A map displaying lynx habitat and linkage areas is available for consideration in planning efforts. They are mapped at a broad scale and need further refinement to be fully utilized. The lynx linkage areas that were identified for the Gallatin Forest include the North Bridgers to the Big Belt Mountains area, Castle Mountains to northern Crazy Mountains area, Crazy Mountains to the Absaroka Mountains area, the Crazy Mountains to Bridger Range area, the Bridger Range to Gallatin Range area (Bozeman Pass), the Henry's Lake Mountains to Gravelly Range area (Reynolds Pass), the Gallatin Range to Absaroka Mountains area (Yankee Jim), and areas between the Cooke City to Yellowstone National Park and Custer National Forest areas. There is no specific direction of how to manage for these linkage areas relative to travel planning, habitat manipulation, or development. In addition, the North Bridgers to the Big Belt Mountains, Crazy Mountains to the Absaroka Mountains, the Crazy Mountains to Bridger Range, the Gallatin Range to Absaroka Mountains (Yankee Jim), and Cooke City linkage areas that transverse large areas of non-habitat, poor quality habitat, and private lands are influenced by many factors including highways, interstates, railroad beds, rivers, and land development of which the Gallatin Forest has no control. See Issue 3: Biological Diversity and Ecological Sustainability for a further discussion of effects on potential lynx corridors and linkages.

Effects by LAU - Summer

Table 3.13.5 displays all the LAUs on the Gallatin National Forest and their respective summer ORD, by alternative. The LCAS provides a programmatic guideline for Forest backcountry roads and trails relative to road density of over 2 mi/ sq mi. As described above, Alternative 2 is used as the baseline for comparison as it most closely represents the existing condition.

Table 3.13. 5 Summer motorized open road and motorized trail density (gross), by LAU, by alternative.

Lynx Analysis Unit	Summer motorized open road and motorized trail density by LAU (in mi/sq mi)						
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7-M
AB Wilderness	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beartooth Plateau	0.3	0.3	0.3	0.3	0.2	0.2	0.2
Bridger/Bangtails	1.9	1.9	2.0	1.8	1.7	1.7	1.7
East Boulder	0.9	0.9	0.8	0.6	0.5	0.4	0.4

Lynx Analysis Unit	Summer motorized open road and motorized trail density by LAU (in mi/sq mi)						
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7-M
East Crazies	0.6	0.6	0.5	0.5	0.5	0.5	0.5
East Gallatin	1.5	1.5	1.3	1.1	1.1	1.0	1.0
Emigrant	0.4	0.4	0.5	0.5	0.5	0.5	0.5
Gardiner-Tom Miner	0.8	0.8	0.7	0.7	0.7	0.7	0.7
Henry's Lake Mtns	1.2	1.2	1.2	1.2	1.0	0.9	0.9
Horseshoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Main Boulder	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Mill Creek	0.6	0.6	0.5	0.4	0.4	0.4	0.4
North Absaroka	0.2	0.2	0.2	0.1	0.1	0.1	0.1
North Gallatin	1.4	1.4	1.5	1.5	1.4	1.3	1.3
North Madison	1.1	1.2	1.2	1.2	1.2	1.1	1.1
South Fork Madison	1.6	1.6	1.6	1.6	1.6	1.5	1.5
Upper Gallatin	0.5	0.5	0.5	0.5	0.5	0.3	0.3
Upper Madison	0.6	0.5	0.5	0.4	0.4	0.3	0.3
West Boulder	0.1	0.1	0.0	0.0	0.0	0.0	0.0
West Crazies	1.4	1.4	1.6	1.4	1.2	1.1	1.1
West Gallatin	1.1	1.1	1.1	1.0	0.9	0.7	0.7
TOTAL	0.8	0.8	0.8	0.8	0.7	0.6	0.7

There are no LAUs that do not meet the 2 mi/ sq mi guideline in any of the alternatives. Any roads targeted for an improvement in level of construction and maintenance standard would likely encourage a higher level of public use. However, this is probably not an issue since all LAUs have an ORD of < 2 mi/sq mi. Programmatic management objectives would serve to minimize the increased vulnerability to lynx due to improved road standards.

Effects by Alternative - Summer

With the implementation of any of the alternatives, lynx would continue to avoid open areas and use mature forest or forest with dense cover, tall shrubs, and well-vegetated riparian areas as travel corridors. Roads less than 50 feet wide with good cover along both edges openings <100 meters (approximately 300 ft) in width would still be crossed. However, lynx travel and hunting patterns may be disrupted.

Lynx potentially in and around areas frequented by humans may be displaced. This may put lynx at further risk of human-induced mortality and increase their vulnerability to hunters and trappers (illegal or non-target trapping, accidental vehicle death, or illegal shooting). Summer use of roads may also increase the vulnerability of any kittens potentially using denning habitat. However, there are no alternatives that exceed the LCAS programmatic guideline for Forest backcountry roads and trails relative to road density of 2.0 mi/ sq mi guideline for any LAUs.

Effects by LAU - Winter

Increases in either snowmobile or ski routes were analyzed in order to address the Recreation Management (S1) and Forest/ Backcountry Roads and Trails (S1) programmatic level standards and

the Mortality Risk Factor programmatic level standard (S1). Any net increase in groomed or marked (and therefore "designated") over-the-snow routes must be accompanied by a consolidation of use resulting in a net reduction of compacted snow areas within the same LAU (Mcallister 2003). Therefore, a simple deduction of changes in route miles is not enough to determine if each LAU meets or does not meet this management direction. These LAUs are discussed in more detail to determine if they meet the intent of the LCAS standards and guidelines.

A few of the LAUs had no net change or net decreases in route miles of over-the-snow marked or groomed routes and also had no net change or an increase in closed snowmobile areas for all alternatives. These LAUs are within, lead to, or strongly overlap designated Wilderness areas. They appear in Table 3.13.6 as shaded rows and include: AB Wilderness, Beartooth Plateau, East Boulder, East Crazies, Horseshoe, Main Boulder, North Absaroka, and West Boulder LAUs. These LAUs meet the Recreation Management (S1) and Forest/ Backcountry Roads and Trails (S1) programmatic level standards and the Mortality Risk Factor programmatic level standard (S1) for over-the-snow routes.

The decreases in route miles or increase in snowmobile closure area acres are due to the alternatives responding to various resource issues or concerns. The effect to lynx of decreased over-the-snow routes and increased snowmobile area closures may be a reduction in vulnerability to illegal or non-target trapping and shooting, a reduction in potential competition with other predators and an improved ability to capitalize on an undisturbed habitat niche. However, the degree to which these effects may occur depends on actual lynx presence and the confirmed evidence through research that these mortality risks pertain to the lynx population on the Gallatin Forest.

The remainder of the LAUs had an increase or a decrease in route miles and an increase in percent snowmobile closure area, which varies by alternative (only Alternative 3 in Henry's Lake Mountains LAU resulted in a decrease in snowmobile closure area). Some increases in route miles were only from ski routes, not snowmobile routes, or vice versa. It is important to note that some routes currently exist on the ground, and are receiving some level of use, but count as an increase in route miles due to the alternative proposal to mark or groom the route, i.e. "designate". Also of note is that all over-the-snow routes and areas were calculated regardless of whether they traveled through or consisted of lynx habitat. Therefore, the data is somewhat conservative in favor of lynx.

There is no measure of the level of use each of these designated routes receives. An assumption made is that the closer proximity to high population centers (Bozeman) or high quality snowmobiling (Cooke City and West Yellowstone), the more accessible and, therefore, more use occurs. A higher frequency of use may also equate to a pattern of activity such that consistent compaction occurs in those areas. This may or may not translate to a true biological effect if the use is already occurring on a particular route and the only difference is by virtue of the designation. The variations of these qualitative parameters are discussed by LAU and by alternative.

Table 3.13.6 and Table 3.13.7 display all the LAUs on the Gallatin National Forest and their respective total miles of designated over-the-snow marked or groomed routes and acres and percent of closed snowmobile area, by alternative.

Table 3.13. 6 Miles of designated over-the-snow routes, and acres and percent of closed snowmobile area, by alternative by LAU.

LYNX ANALYSIS UNIT	Miles of snowmobile/ski routes, Acres and percent closed snowmobile area																				
	Alt. 1			Alt. 2			Alt. 3			Alt. 4			Alt. 5			Alt. 6			Alt. 7-M		
	Mi	Acres	%	Mi	Acres	%	Mi	Acres	%	Mi	Acres	%	Mi	Acres	%	Mi	Acres	%	Mi	Acres	%
AB Wilderness	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beartooth Plateau	40	0	0	40	0	0	40	0	0	39	3764	5	39	3764	5	39	3764	5	39	1028	1
Bridger/Bangtails	66	4729	5	79	6752	8	99	24578	28	99	24578	28	70	44500	50	82	24578	28	69	19280	22
East Boulder	13	0	0	6	0	0	6	1564	2	6	1564	2	6	1564	2	6	1564	2	2	0	0
East Crazies	0	0	0	0	0	0	0	46918	100	0	46918	100	0	46949	100	0	46918	100	0	46938	100
East Gallatin	5	21200	24	12	21200	24	12	37857	42	12	63291	70	7	74595	83	11	72966	81	6	76552	85
Emigrant	2	11005	16	2	11029	16	8	11968	17	8	11968	17	2	11970	17	2	11968	17	8	19531	28
Gardiner-Tom Miner	21	31709	25	21	31709	25	23	61778	48	23	61778	48	21	68378	54	23	67259	53	22	66838	53
Henry's Lake Mtns	5	24725	51	5	24725	51	20	22254	46	5	24918	52	5	25116	52	5	25116	52	5	28225	59
Horseshoe	15	0	0	15	0	0	15	2396	3	15	2396	3	15	2740	3	15	2396	3	15	0	0
Main Boulder	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0
Mill Creek	20	0	0	20	3525	6	26	3525	6	28	3525	6	20	6441	10	17	3525	6	29	5044	8
North Absaroka	2	1683	3	2	1683	3	2	6136	10	2	6136	10	2	16709	28	2	6136	10	2	2849	5
North Gallatin	82	31439	35	78	31439	35	103	52338	58	99	69616	77	86	69617	77	93	69617	77	90	62060	69
North Madison	37	452	<1	37	452	<1	40	31839	27	40	34939	29	38	34939	29	40	34939	29	38	32652	28
South Fork Madison	66	4676	12	66	4676	12	82	4676	12	74	4676	12	66	4710	12	74	11964	31	71	4864	13
Upper Gallatin	14	19083	16	14	19083	16	37	23903	20	14	23903	20	14	26347	22	14	64345	53	25	45478	38
Upper Madison	31	5499	6	31	5499	6	31	14449	16	31	14449	16	31	15606	17	28	72078	77	37	8076	9
West Boulder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West Crazies	23	0	0	23	0	0	33	94	<1	37	94	<1	30	32957	48	32	94	<1	40	22594	33
West Gallatin	87	22354	18	87	22354	18	116	29853	24	116	32253	26	89	47837	39	95	58977	48	106	54972	45
TOTAL	535	178554	10	544	184126	10	699	376126	21	654	430766	26	547	534739	30	584	578204	32	610	496981	28

The remainder of the LAUs indicated an increase or no net change in snowmobile or ski route miles, with three exceptions. North Gallatin, Mill Creek, and Upper Madison LAUs showed a decrease in over-the-snow route miles in Alternative 2, 6, and 6 *respectively*. Table 3.13.7 summarizes the degree of increase or decrease of route miles and snowmobile closure area of each LAU, by alternative. Decreases in miles by LAU, by alternative are displayed in parentheses () to indicate a decrease.

Table 3.13.7 LAUs/ alternatives with increase or (decrease) above baseline of over-the-snow routes and acres of snowmobile area closure.

Lynx Analysis Unit	Miles of increase or (decrease) over baseline											
	Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6		Alt. 7-M	
	Net ↑	Acres of ↑	Net ↑	Acres of ↑	Net ↑	Acres of ↑	Net ↑	Acres of ↑	Net ↑	Acres of ↑	Net ↑	Acres of ↑
Bridger/ Bangtails	13	2023	33	19849	33	19849	4	39771	16	19849	3	14551
East Gallatin	7	0	7	16657	7	42091	2	53395	6	51766	1	55352
Emigrant	0	24	6	963	6	963	0	965	0	963	6	8526
Gardiner-Tom Miner	0	0	2	30069	2	30069	0	36669	2	35550	1	35129
Henry's Lake Mtns	0	0	15	-2471	0	193	0	391	0	1636	0	3500
Mill Creek	0	3525	6	3525	8	3525	0	6441	(3)	3525	9	5044
North Gallatin	(4)	0	21	20899	17	38177	4	38178	11	38178	8	30621
North Madison	0	0	3	31387	3	34487	1	34487	3	34487	1	32200
South Fork Madison	0	0	16	0	8	0	0	34	8	7288	5	188
Upper Gallatin	0	0	23	4820	0	4820	0	7264	0	45262	11	26395
Upper Madison	0	0	0	8950	0	8950	0	10107	(3)	66579	6	2577
West Crazies	0	0	10	94	14	94	7	32957	9	94	17	22594
West Gallatin	0	0	29	7499	29	9899	2	25483	8	36623	19	32618

The LAUs displayed in Table 3.13.7 would only meet the Recreation Management (S1) and Forest/ Backcountry Roads and Trails (S1) programmatic level standards or the Mortality Risk Factor programmatic level standard (S1) for the alternative(s) shown if the designation resulted in a net reduction of area open to snowmobiles or skiing through a consolidation of unregulated use (per Mcallister 2003). LCAS management direction for a specific LAU would be met if it showed a decrease in route miles or no net increase in over-the-snow route miles, i.e., zero. For those LAUs and alternatives that show a combination of an increase in over-the-snow routes and a corresponding increase in areas closed to snowmobiles, some level of compensation may be occurring such that they would be in compliance with LCAS management direction. These data are generated from the proposed travel plan route configuration and do not necessarily represent a true biological effect of increased snow compaction. Therefore, these numbers were further examined route by route to determine if the route was already receiving some level of use, if the route was within or adjacent to lynx habitat, and if the amount, location, and habitat quality of snowmobile closure areas served to consolidate use within the LAU.

As discussed in the direct and indirect effects section above, increases in over-the-snow compaction (by either routes or areas) may have detrimental effects to lynx habitat and lynx populations. Snowmobile trails maintained for winter recreation may increase lynx vulnerability to illegal or non-target trapping and enable coyotes and bobcats to access lynx winter habitat. Access to other predators may facilitate competition by killing hares (resource overlap) or by directly killing lynx.

However, moderate levels of snowmobile traffic may be tolerated, particularly when forest edges are available or the trails are narrow. Both snowmobiles and skiing can produce compacted areas off-trail that could enable competing predators access into areas not normally traveled during the winter. This may be important when considering the effect of snowmobile areas closed to use; skiing may still be occurring and providing some level of compaction thus limiting the compensatory benefit of the closure. As mentioned above, there is no differentiation between snowmobile routes or ski routes relative to effect on lynx.

For LAUs that indicate an increase in over-the-snow routes and a corresponding increase in snowmobile closure area, additional information is presented below by alternative. Alternative 1 does not result in increases in over-the-snow routes or changes in snowmobile closure areas and serves as the baseline for alternative comparison as it most closely resembles the existing condition for winter use. There may be new areas of compaction due to summer routes identified as connectors that would be constructed through forested areas currently not accessible to snowmobilers or skiers. These would not be marked or groomed during the winter but if they occur within an area open to snowmobiles, additional compaction may occur. Additional qualitative parameters are considered to evaluate if the net increase in route miles and corresponding area closure does equate to an overall decrease in snow compaction.

Bridger/Bangtails

The Bridger/Bangtails LAU on the Bozeman Ranger District indicates a net increase of over-the-snow routes under all alternatives. The amount of area closed to snowmobiles varies by alternative. This LAU is close to Bozeman and receives regular snowfall which makes these routes relatively more accessible and likely to receive relatively more use than other LAUs. The intensity and frequency of snowmobile and ski activity produces fairly consistent snow compaction. Bridger Bowl Ski Area and Bohart Ranch Cross-country Ski Center are existing sources of snow compaction within and adjacent to ski area boundaries. Summer connectors proposed in this LAU would not receive additional use or have an effect on lynx due to the routes not being in lynx habitat, located in areas of poor snow quality, or in open terrain that would not require tree removal.

Where the routes designated as marked or groomed currently receive some level of dispersed snowmobile and/ or ski use, the newly designated routes would not substantially add new areas of consistent snow compaction to the LAU. Area closures to snowmobiles increase above baseline in all alternatives and serves to provide some level of compensation for the increase in marked and groomed routes. This is especially true in the Bridger range where the lynx habitat is of a higher quality than the Bangtails. Areas proposed for closure are considered rideable snowmobile terrain and contain quality lynx habitat. However, some of this benefit may not be realized where skiers venture into the backcountry and compact snow in those areas closed to snowmobiles.

Alternatives 2-4 would not meet the intent of the LCAS due to the high increase in routes and low compensatory closure area acres. Alternatives 5 and 6 provide the most favorable juxtaposition of designated routes to snowmobile closure areas. Alternative 7-M indicates a net increase of only 3 miles due to the currently designated ski routes in the Bangtails being dropped from the system. This is more realistic due to marginal snow conditions and lack of use but would not realize any benefits to lynx as the area would still be open to snowmobiles and receive dispersed use and consistent compaction. Alternative 7-M would maintain the southwest side as open to

snowmobiles, much of which is not capable and is poor quality lynx habitat. This alternative would allow snowmobile use in the Fairy Lake area which would still receive heavy use and compaction by backcountry skiers if it were closed to snowmobiles. It would further restrict snowmobile use on the northwest side of the Bridger ridge which is less accessible to backcountry skiers, considered rideable snowmobile terrain, and contains approximately the same amount of lynx habitat as the Fairy Lake area where snowmobiling would be allowed. While this may appear to break up the connectivity north to south, it would still serve to concentrate use on marked and groomed routes and reduce overall compaction across the landscape, thus meeting the intent of the LCAS.

East Gallatin

The East Gallatin LAU on the Livingston Ranger District indicates net increases in over-the-snow route miles above baseline in all alternatives. Many of the route mile increases on the north end of the LAU are shared trails and/ or close to the Bozeman area, currently receiving use by both snowmobiles and skiers. Alternative 2 does not have any additional snowmobile closure areas to compensate for the increase in route miles and Alternative 3 does not sufficiently serve to consolidate use through the snowmobile closure areas due to the relatively small snowmobile closure area acres. In Alternative 4 through 7-M there are large blocks of closure within the Wilderness Study Area that are serving to consolidate use on designated routes, approximately ½ of which is mapped lynx habitat. While much of these closure areas are not necessarily rideable terrain, there is high quality habitat within the closure areas that would remain inaccessible and uncompacted. Alternative 2 and 3 do not meet the intent of the LCAS due to high increase in route miles and/ or low compensatory closure acres. Alternatives 4 through 7-M meet the intent of the LCAS due to the lack of additional compaction and the high quantity and quality of lynx habitat within large closure areas.

Emigrant

The Emigrant LAU on the Livingston Ranger District indicates no net change in over-the-snow route miles in Alternatives 2, 5, and 6 and a net increase of 6 mi of over-the-snow routes under Alternatives 3, 4, and 7-M. These routes are within what is considered rideable snowmobile terrain although access and snow quality can be poor. The majority of proposed route length increase is not in lynx habitat. Snowmobile closure area acres increase in all alternatives over the baseline. The additional snowmobile closure area in Alternative 7-M would serve to consolidate use and reduce compaction although some of this compensation may be negated by occasional backcountry skier use. Alternatives 2, 5, 6, would meet the LCAS due to no net change in route miles. Alternative 7-M would meet the LCAS due to no additional compaction in lynx habitat, route mile increase occurs in areas already receiving snowmobile use, majority of route not in lynx habitat and/ or sufficient snowmobile area closure. Alternatives 3 and 4 would not meet the LCAS because of the net increase in route miles and no compensatory closure area acres.

Gardiner-Tom Miner

The Gardiner-Tom Miner LAU on the Gardiner District indicates no net change in over-the-snow route miles in Alternatives 2 and 5, a net increase of 2 miles in Alternatives 3, 4, and 6, and 1 mile net increase in Alternative 7-M. These routes are already being used by snowmobilers and skiers so there would be no additional snow compaction than what is already occurring. All alternatives indicate a two-fold net increase in snowmobile closure area acres except for Alternative 2. Although only approximately ¼ of the additional closure area acres are lynx habitat, use would be

consolidated to those areas where snowmobile use is allowed. All alternatives would meet the intent of the LCAS.

Henry's Lake Mountains

The Henry's Lake Mountains LAU on the Hebgen Lake Ranger District indicates no net change for all alternatives except Alternative 3. Alternative 3 shows a 15 mile increase in over-the-snow route with a decrease in snowmobile closure area acres and thus does not meet the LCAS. Alternatives 2 and 4 through 7-M do meet the LCAS since there was no change to the amount of over-the-snow route miles.

Mill Creek

The Mill Creek LAU on the Livingston Ranger District indicates no net change in Alternatives 2 and 5 and Alternative 6 indicates a decrease of 3 miles; thus these alternatives meet the LCAS. Alternatives 3, 4, and 7-M have an increase in over-the-snow in route miles by 6, 8, and 9 miles respectively and an increase in snowmobile closure area acres. Approximately ½ of the increase is on a route that already currently receives heavy ski use and is consistently compacted. The route increase is for ski use only within a snowmobile closure area where use would be concentrated on trails as minimal backcountry use opportunities exist. The proposed snowmobile closure area includes lynx habitat and some rideable snowmobile terrain that would eliminate snowmobiles where dispersed use currently occurs and concentrate use in the mainstem of Mill Creek. The Mill Creek area is close to Livingston and currently receives heavy use during winter by snowmobilers, skiers, dog-sledders, and family sledding. None of the alternatives would increase the level of snow compaction above that which already exists and therefore the alternatives meet the LCAS.

North Gallatin

The North Gallatin LAU on the Bozeman Ranger District indicates a net increase in all the alternatives except Alternative 2. Many of these routes are existing roads or open areas that currently receive some level of dispersed use. These alternatives also indicate an increase in snowmobile closure area acres. The proposed snowmobile closure areas include rideable snowmobile terrain within or adjacent to quality lynx habitat. Summer connectors proposed in this LAU may require tree canopy removal on portions of the identified routes, potentially increasing accessibility and additional use but there is heavy snowmobile and/ or ski use immediately adjacent to these areas and/ or the routes are not in lynx habitat so the effect would be minimal.

While Alternatives 3 through 7-M have approximately the same level of snowmobile area closure configuration, Alternative 3 and 4 have 21 and 17 mile increases compared to 4, 11, and 8 miles for Alternatives 5 through 7-M respectively. Alternative 3 and 4 do not meet the intent of the LCAS as compared to Alternatives 5 through 7-M. This comparison is important due to the proximity of this LAU to the Bozeman area and the relative frequency and intensity of all winter activities. All of the drainages within this LAU (Little Bear, Cottonwood, Hyalite, and Bozeman Creek) receive heavy use of allowable activities and are managed to create a separation of uses between drainages. If Hyalite Creek road would be plowed to allow better winter access, this would further increase accessibility and intensity creating areas of consistent snow compaction. Thus, the lower the ratio of route miles to snowmobile closure area acres, the closer to meeting the intent of consolidation of use resulting in a net reduction of compacted snow areas within the same LAU.

Alternative 7-M plows the Hyalite road while at the same time allowing snowmobiles access to both lower (reduction of snowmobile closure areas acres from Alternatives 4-6 in Moser Creek area) and upper (high elevation basins) portions of the Hyalite drainage. This potentially reduces the overall benefit of attempted consolidation of compaction. However, across the entire LAU, Alternative 7-M closes approximately twice as much area to snowmobiles as is closed currently, ½ of which is lynx habitat, thus meeting the intent of the LCAS. Alternative 2 indicates a net decrease of 4 miles and would therefore meet the LCAS.

North Madison

The North Madison LAU on the Bozeman Ranger District indicates an increase in over-the-snow route miles for Alternatives 3 through 7-M. The routes to be designated already receive heavy skier use. Summer connectors proposed in this LAU would go through stringers of forested areas with open areas in between which may increase localized accessibility but heavy snowmobiling use occurs in the basins immediately above these connectors.

These alternatives also indicate substantial snowmobile area closures but would result in little benefit to lynx. While mapped as lynx habitat, the proposed closures adjacent to the Lee Metcalf Wilderness are not considered rideable terrain and receive intermittent snowmobile use. However, any snowmobile activity that does occur would be restricted resulting in an overall net reduction in compaction. Alternative 2 indicated no net increase in over-the-snow route miles and thus meets the LCAS. Big Sky, Moonlight, and Yellowstone Club ski areas are privately owned acres within this LAU and vastly contribute to a level of snow compaction.

South Fork Madison

The South Fork LAU on the Hebgen Lake Ranger District indicates that over-the-snow route miles and snowmobile closure area acres varies by alternative. Alternatives 2 and 5 indicate no net increase in route miles and therefore meet the LCAS. Alternatives 3 and 4 indicate a net increase of 16 and 8 miles respectively, with no corresponding snowmobile closure area acres and do not meet the LCAS. Alternative 6 indicates an 8 mile net increase in over-the-snow routes with substantial snowmobile closure area acres and best meets the LCAS. Alternative 7-M indicates a net increase of 5 route miles and a slight increase in snowmobile closure area acres. This increase in over-the-snow route miles is due to a route that is currently heavily used by snowmobiles and snow packed now on a regular basis. While there is no measurable compensation of area closure for net increase in designated route, this route already receives consistent compaction.

This LAU is immediately adjacent to West Yellowstone and very accessible for snowmobile opportunities close to town and Yellowstone Park. This proximity, combined with the groomed Rendezvous Ski Trail system, creates use patterns of high intensity and frequency.

Upper Gallatin

The Upper Gallatin LAU on the Hebgen Lake Ranger District indicates no net increase in over-the-snow route miles for Alternatives 2 and 4-6. Alternative 3 has a net increase of 23 miles without a substantial increase in snowmobile area acres and does not meet the intent of the LCAS. This LAU includes the Taylor Fork drainage which is a very popular recreation destination. Alternative 7-M has an increase in snowmobile closure area acres which is about a 3 fold increase in high quality lynx habitat closed to snowmobiles and considered snowmobile rideable terrain, serving to

concentrate use in the lower portion of Taylor Fork drainage. The 11 mile net increase in over-the-snow routes includes a route to access the Wapiti cabin from the Sage Creek trailhead. These routes are currently used resulting in no net change in compaction. All alternatives, with the exception of Alternative 3, meet the LCAS.

Upper Madison

The Upper Madison LAU on the Hebgen Lake Ranger District indicates that Alternatives 2-5 have no net increase and Alternative 6 a net decrease in over-the-snow route miles. The increase in route miles in Alternative 7-M reflects the designation of Road #989 as a designated route through a snowmobile area closure. The type and pattern of activity on this route would not change with the new designation. There is also an increase in snowmobile area closure acres which is considered rideable snowmobile terrain but not considered high quality lynx habitat. The majority of the substantial snowmobile closure area acres north of Quake Lake that are included in Alternatives 3-6 were not included in Alternative 7-M due to the area considered not being capable for snowmobiling and lack of resource concerns. This LAU is immediately adjacent to West Yellowstone and very accessible for snowmobile opportunities close to town and Yellowstone Park, creating use patterns of high intensity and frequency where snowmobiling is allowed. None of the alternatives would increase the level of snow compaction above that which currently occurs.

West Crazies

The West Crazies LAU on the Livingston Ranger District indicates a net increase in over-the-snow route miles for all alternatives except Alternative 2 which shows no net change. What differentiates these alternatives is the amount of net increase with consideration of the amount of snowmobile area closure acres. Alternatives 3, 4, and 6 have net increases of 10, 14, and 9 miles respectively but with only a slight increase in snowmobile closure area acres. Alternatives 5 and 7-M have net increases of 7 and 17 miles respectively but with substantial amounts of snowmobile closure area acres, approximately ½ of which is quality lynx habitat. The routes that are proposed to be marked include ski trails joining Porcupine and Ibex Cabins. This area currently receives some dispersed snowmobile and ski use and is considered rideable terrain although weather conditions and land ownership dictate use due to marginal snow and poor public access. The proposed snowmobile closure would preclude snowmobile use in some areas currently receiving use and would serve to consolidate use to marked, groomed, or areas otherwise open to snowmobiles. Some backcountry skiing may occur within these snowmobile closure areas but overall compaction would be reduced.

This LAU is close to the communities of Wilsall and Clyde Park. The designated routes south of Ibex Cabin in Cottonwood Gulch, the Shields loop, and the Smith Creek drainage currently receive heavy snowmobile use and are part of a groomed trail system. The summer route proposed to connect two motorized trails would require tree canopy removal and would increase access to snowmobiles for dispersed use. The entire Smith Creek drainage is open to snowmobiles so there is use already occurring in the general vicinity but this new route may encourage a small amount of additional compaction. Alternatives 2, 5, and 7-M would meet the intent of the LCAS due to the favorable combination of net increases in route miles and snowmobile closure area acres. Alternatives 3-4 and 6 would not meet the intent of the LCAS due to the high increase in routes and low compensatory closure area acres.

West Gallatin

The West Gallatin LAU on the Bozeman Ranger District indicates a net increase in over-the-snow route miles for all alternatives except Alternative 2 which shows no net change. There is also an increase in snowmobile closure area acres for those alternatives with net increases in route miles. However, Alternative 3 and 4 which have substantial increases in route miles (29 miles) with minimal snowmobile closure area acres, do not serve to consolidate use across the landscape, and therefore, do not meet the intent of the LCAS.

The routes in Alternatives 5 through 7-M that indicate a net increase are currently receiving use as part of existing system or are routes proposed to be marked through snowmobile closure areas. This designation would serve to concentrate use on the marked or groomed routes with large areas closed to snowmobiles, much of which is lynx habitat. This LAU is relatively close to Bozeman (and the Big Sky area) and offers adequate snow conditions for winter activities, creating a pattern of consistent snow compaction across the landscape where snowmobiles are allowed.

The following Table 3.13.8 indicates which LAUs would be in compliance with the LCAS. Those LAU - alternative combinations that do not meet the LCAS are shaded for ease of viewing.

Table 3.13. 8 LAUs Compliance with LCAS by Alternative (Yes or No).

LAU	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7-M
AB Wilderness	Y	Y	Y	Y	Y	Y	Y
Beartooth Plateau	Y	Y	Y	Y	Y	Y	Y
Bridger/Bangtails	Y	N	N	N	Y	Y	Y
East Boulder	Y	Y	Y	Y	Y	Y	Y
East Crazies	Y	Y	Y	Y	Y	Y	Y
East Gallatin	Y	N	N	Y	Y	Y	Y
Emigrant	Y	Y	N	N	Y	Y	Y
Gardiner-Tom Miner	Y	Y	Y	Y	Y	Y	Y
Henry's Lake Mtns	Y	Y	N	Y	Y	Y	Y
Horseshoe	Y	Y	Y	Y	Y	Y	Y
Main Boulder	Y	Y	Y	Y	Y	Y	Y
Mill Creek	Y	Y	Y	Y	Y	Y	Y
North Absaroka	Y	Y	Y	Y	Y	Y	Y
North Gallatin	Y	Y	N	N	Y	Y	Y
North Madison	Y	Y	Y	Y	Y	Y	Y
South Fork Madison	Y	Y	N	N	Y	Y	Y
Upper Gallatin	Y	Y	N	Y	Y	Y	Y
Upper Madison	Y	Y	Y	Y	Y	Y	Y
West Boulder	Y	Y	Y	Y	Y	Y	Y
West Crazies	Y	Y	N	N	Y	N	Y
West Gallatin	Y	Y	N	N	Y	Y	Y

Effects by Alternative - Winter

Alternative 1

Alternative 1 may add direct, indirect and cumulative effects to the existing situation. Assuming human recreational activities increase in the future, this alternative has the most potential to affect lynx long term. There is no reasonable logistical way to deter an increase in snowmobile use without designating routes with area closures as proposed in Alternatives 2 through 7-M. Snowmobile and ski accessible areas would continue to increase where land topography, snow conditions, and increased technology make it feasible. Regardless of the effects that Alternative 1 may have long-term, it is used as a baseline from which to compare all the other alternatives and measure LCAS standards and guidelines. Displaying the identified parameters (over-the-snow route miles and areas closed to snow compaction by snowmobiles) is meant to take a Forest-wide look at the effect of the Alternative route and area configuration across all LAUs.

Table 3.13. 9 Alternatives with increase of over-the-snow routes and acres of snowmobile area closure above baseline.

Alternative Totals for all LAUs Forest-wide	Over-the-Snow Route Miles Net Increase from Alternative 1	Acres of Snowmobile Closure Area Net Change from Alternative 1	Acres of Lynx Habitat within Snowmobile Closure Area	Alternative Meets LCAS Y/N
2	9	5,572	3,068	N
3	164	197,572	97,367	N
4	119	252,212	126,880	N
5	12	356,185	180,073	Y
6	49	400,895	220,870	N
7-M	75	318,427	169,786	Y

Alternative 2

This alternative would not be in compliance due to Bridger/Bangtails and East Gallatin LAUs not meeting the intent of the LCAS.

Alternative 3

This alternative would not be in compliance due to Bridger/Bangtails, East Gallatin, Emigrant, Henry's Lake Mountains, North Gallatin, South Fork Madison, Upper Gallatin, West Crazies, and West Gallatin LAUs not meeting the intent of the LCAS.

Alternative 4

This alternative would not be in compliance due to Bridger/Bangtails, Emigrant, North Gallatin, South Fork Madison, West Crazies, and West Gallatin LAUs not meeting the intent of the LCAS.

Alternative 5

This alternative would be in compliance with the LCAS due to all LAUs meeting the intent of the LCAS.

Alternative 6

This alternative would not be in compliance due to the West Crazies LAU not meeting the intent of the LCAS.

Alternative 7-M

This alternative would be in compliance with the LCAS due to all LAUs meeting the intent of the LCAS.

Effects on Habitat Connectivity

Proposed management direction in the form of stated Forest-wide Goals (Goal E. in the DEIS, Goal F. in the FEIS) would serve to highlight and potentially protect those areas considered important to lynx movement. It is unclear how the habitat connectivity of individual alternatives by LAU would be affected through their implementation as proposed. Linkages and opportunities for dispersion improve habitat quality for both individuals and populations. The habitat connectivity considerations may also apply at a local scale. Lynx may obtain some benefit from the implementation of the Montana/Dakota OHV decision area closure and proposed summer designated routes and the proposed designation of over-the-snow winter routes and snowmobile closure areas, common but variable in Alternatives 2 through 7-M. This would provide some benefit to lynx by concentrating human activity and allowing areas of seclusion outside of the travel corridors. According to a recently published Federal Register (USDI 2003), it is unclear what role traffic and roads play in lynx movement. Monitoring would provide long-term information regarding what areas are consistently compacted and what areas may be available for dispersal or use as a corridor (see Appendix B). See Issue 3: Biological Diversity and Ecological Sustainability for further discussion of effects on potential lynx corridors and linkages.

Summary of Effects by LCAS Conservation Measures

Table 3.13.10 summarizes the applicable LCAS conservation measures discussed in the Analysis Methodology section and the extent to which the action alternatives meet them.

Table 3.13. 10 Relationship of proposed alternatives to applicable conservation measures.

Project Planning (7-4)	
Standards	**Meets – Yes/ No**
S3 - Maintain habitat connectivity within and between LAUs.	**YES** for all alternatives – There are no changes to lynx habitat proposed with the Travel Plan as no vegetation treatment is proposed. All alternatives meet the guideline for < 2.0 miles/ sq mile. Also, see Forest-wide Goal for Wildlife Corridor (Goal E in the DEIS and Goal F in the FEIS).

Recreation Management (7-9) - Programmatic Level	
Standards and Guidelines	**Meets – Yes/ No**
S1 - On federal lands in lynx habitat, allow no net increase in groomed or designated over-the-snow routes and designated snowmobile play areas by LAU unless the designation serves to consolidate unregulated use and improves lynx habitat though a net reduction of compacted snow area (Ruediger et al. 2000, Mcallister 2003).	**YES and NO -** Refer to Table 3.13.X for LAUs and highlighted alternatives that indicate compliance and intent of each alternative meeting the LCAS. Some LAUs meet the LCAS for all alternatives; All LAUs meet the LCAS for only Alternative 5 and 7-M.
S2 - Map and monitor the location and intensity of snow compacting activities… that coincide with lynx habitat, to facilitate future evaluation of effects on lynx as information becomes available.	**YES** for all alternatives - See Appendix B.
Forest/Backcountry Roads and Trails (7-10) – Programmatic Level	
Standards and Guidelines	**Meets – Yes/ No**
S1 - On federal lands in lynx habitat, allow no net increase in groomed or designated over-the-snow routes and snowmobile play areas by LAU.	See Recreation Management S1 above.
G1 - Determine where high total road densities (>2 mi/sq mi) coincide with lynx habitat, and prioritize roads for seasonal restrictions or reclamation in those areas.	**YES** – for all LAUs, all alternatives. Refer to Table 3.13.5 for summer motorized open road density by LAU by alternative.
Mortality Risk Factors - Programmatic Level Standards and Guidelines (LCAS, 7-12 to 16)	
Trapping (7-12)	**Meets – Yes/ No**
G1 - Federal agencies should work cooperatively with states and tribes to reduce incidental take of lynx related to trapping.	**YES** for all alternatives – On-going cooperation and communication regarding snow tracking surveys for lynx and trapping regulations. MDFWP has closed the trapping season for lynx.
Shooting (7-12)	**Meets – Yes/ No**
G1 - Initiate interagency information and education efforts throughout the range of lynx in the contiguous states. Utilize trailhead posters, magazine articles, news releases state hunting and trapping regulation booklets, etc., to inform the public of the possible presence of lynx, field identification, and their status.	**YES** for all alternatives - Upon implementation of the selected Travel Plan alternative, travel maps would be produced that clearly display areas open and closed to public access, including those routes and areas open for over-the-snow recreation. Other on-going conservation education efforts are accomplished at the programmatic level.
Competition and Predation as Influenced by Human Activities (7-13)	**Meets – Yes/ No**
S1 - On federal lands in lynx habitat, allow no net increase in groomed or designated over-the-snow routes and designated snowmobile play areas by LAU unless the designation serves to consolidate unregulated use and improves lynx habitat though a net reduction of compacted snow area.	See Recreation Management S1 above.

Movement and Dispersal - Programmatic Level Standards and Guidelines (LCAS, 7-12 to 16)	
Highways (7-14)	**Meets – Yes/ No**
G1 - Dirt and gravel roads traversing lynx habitat (particularly those that could become highways) should not be paved or otherwise upgraded … in a manner that is likely to lead to significant increases in traffic volumes, traffic speeds, increased width of the cleared ROW, or would foreseeably contribute to development or increases in human activity in lynx habitat.	**YES** for all alternatives - Additional NEPA analysis would have to be completed for any newly constructed routes or where any ground-disturbance would be required for the implementation of the selected alternative. See Issue 3: Biological Diversity and Ecological Sustainability for further discussion of effects on potential lynx corridors and linkages.

Cumulative Effects

Net Effects of Past and Present Programs and Activities

Many of the programs and activities that occur on the Gallatin National Forest have some influence on lynx or lynx habitat. Adverse or negative effects considered together have contributed to the risk factors which partially led to the listing of lynx as a threatened species under the Endangered Species Act. The risk factors include National Forest programs, practices, and activities that may directly, indirectly, or cumulatively influence lynx or lynx habitat in four major areas: 1) productivity, 2) mortality, 3) movement and dispersal, and 4) other large scale factors. In the determination to list lynx, the FWS concluded that the lack of Forest Plan guidance for lynx conservation, as evidenced by the fact that Forest Plans allow or direct actions that may cumulatively, adversely affect lynx was a significant threat to lynx.

The combined effects of past and present activities and programs define the current baseline condition on the Gallatin Forest against which the alternatives were evaluated. Based on the past and current vegetation management of the Gallatin Forest, including timber harvest, livestock grazing, prescribed fire, invasive species program and other vegetation projects, forest vegetation conditions provide habitat for foraging, denning, and dispersal as defined in the LCAS. The effects of different types of dispersed recreation including the outfitter/ guide program, recreation residences; fire suppression; and the lands, minerals, and non-recreation special use programs on the Gallatin Forest have minor, or beneficial, impacts to lynx other than what was considered. Conversely, effects of developed ski areas and associated base area development have contributed to a direct loss or modification of habitat that may be affecting lynx denning, foraging, and diurnal security habitat to some degree. All of these activities combined currently occur and contribute to the baseline from which LCAS standards and guidelines were evaluated. A summary is provided in this report with a detailed description of effects of other programs and activities in the project file (Feigley, 3/10/06).

Projected Combined Effects of Reasonably Foreseeable Programs and Activities

Lynx are a wide-ranging species and do not limit their wanderings to the National Forests. It is very difficult to estimate the cumulative effect resulting from management of the National Forests along with neighboring land management and land uses in the reasonably foreseeable future. However, the fundamental aspect of a cumulative effects analysis includes an attempt to consider all the activities that may potentially affect lynx and occur within and adjacent to National Forest.

There would be no cumulative effects expected to occur from timber harvest, prescribed fire, livestock grazing, invasive species control, or other vegetation projects. However, as these activities may be proposed, the adverse effects to lynx productivity, mortality, and movement and dispersal would need to be considered to determine the extent of the cumulative effect, if any. Some vegetation treatment may be beneficial by creating foraging habitat long-term. The reasonably foreseeable projects for the Gallatin Forest would likely treat a variety of forest types at various scales, much of which is low elevation wildland urban interface and not in lynx habitat. Vegetation treatments with a timber harvest component include projects with variable objectives, including fire salvage, fuel reduction, and restoration of fire adapted ecosystems. Livestock grazing and the invasive species problems are expected to continue into the future and would continue irregardless of travel planning. The adaptive management policy that will be implemented as allotment plans are updated and managing noxious weeds through partnerships and noxious weed mapping and range utilization monitoring efforts will minimize habitat degradation. These efforts are consistent with conservation measures identified in the LCAS.

It is not known what wildfires may occur in the future, or how successfully they will be suppressed, creating or destroying foraging and denning habitat over time. The LCAS encourages restoring fire as an ecological process to move toward landscape patterns consistent with historical succession and disturbance regimes.

No cumulative impacts to lynx are expected from the minerals, lands, and non-recreation special use programs. There are no mineral development projects anticipated for the Gallatin Forest other than those currently occurring and abandoned mines would continue to be closed. It is assumed that the trend toward consolidation of National Forest lands would continue to incrementally add acres of lynx habitat to the total amount of lynx habitat on the Gallatin Forest. Small scale and temporary special uses have minor impacts individually, but together with additional permits requiring permanent human infrastructure, may contribute to large scale effects. However, it is unknown at this time the number and scale of any future special use permit requests (or the permitting thereof) so the consequence of this effect is not known.

Cumulative impacts of dispersed summer and winter use along with other activities in lynx habitat such as the outfitter/ guide program and recreation residences was considered through direct and indirect effects analysis as part of the baseline. The LCAS does not recommend limits to these uses above those evaluated in the direct and indirect effects. No cumulative effect is expected.

The greater potential for cumulative adverse impacts and pressure on lynx recovery is likely to be the result of human activity on off-Forest lands. Private lands within the Forest boundary or

immediately adjacent to the Gallatin Forest (including developed ski areas) continue to be developed and may be the most significant impact on lynx. Private developed ski areas would remain on the landscape and most likely increase in size and scale of human developments and populations. Permitted developed ski areas would remain on the landscape with any further development or expansion undergoing analysis relative to LCAS management direction. The USFWS Biological Opinion for the Bridger Bowl expansion project did not define any terms or conditions relative to its recent expansion. The Rendezvous Ski Trails Facility Development Master Plan preferred alternative would result in a net decrease of ski trail mileage and consolidation of groomed trails and would therefore have the lowest potential for competition among lynx and other predators. Cumulative effects to lynx are expected to be low with this project.

Trends indicate increased levels of road improvements on National Forest and road construction adjacent to National Forest on private lands at lower elevations. Construction of roads on private lands contributes to risk factors for lynx productivity, mortality, and dispersal opportunities. The continued trend of road improvements and construction would increase traffic volumes and increase speeds which would contribute to lynx mortality through vehicle collisions, incidental or illegal shooting, and providing access for illegal or non-target trapping. Where these facilities are located in lynx habitat or non-habitat connecting patches of lynx habitat, increased fragmentation may occur and alter how lynx use the landscape. This increasing trend would continue with the selection of any proposed Travel Plan alternative. The LCAS suggests that more research is needed to determine the effects of new road construction and/ or highly roaded areas. Currently, management direction in the LCAS focuses on location of roads, particularly in relation to juxtaposition with lynx habitat and areas of habitat connectivity. Incorporating these guidelines would reduce these affects long-term. Assuming that management direction for both summer and winter recreation activities in lynx habitat would be followed there would be no additional cumulative effect from the Gallatin Travel Plan.

Recent trends to update travel plans on adjacent National Forests through designation of a route system to comply with the 2005 OHV Final Rule (Federal Register, November 9) and the winter use analysis currently undergoing an analysis in Yellowstone Park may have halted further negative effects associated with displacement, disturbance, or death caused by the presence of humans. The trend of ongoing travel plan updates on adjacent landscapes is for designation of roads and trails that is compatible with resource and social issues. If the management direction for both summer and winter recreation activities in lynx habitat is followed as expected, there would be no additional cumulative effect from the Gallatin Travel Plan.

The NRLA process underway proposing to amend Forest Plans in the Northern Rockies would incorporate management direction for Canada lynx based on the Lynx Conservation and Assessment Strategy (Ruediger et al. 2000) and more current research. The NRLA decision and FEIS is expected during 2006, however litigation is likely. The Gallatin Forest is committed to manage consistently with the LCAS as directed by the Conservation Agreement (USDA and USDI 2006) until a final decision is made on the NRLA. When the final decision is made on the NRLA the Gallatin Forest will follow that direction. Any changed management based on the NRLA Forest Plan amendment effort would contribute to maintaining suitable habitat conditions for lynx recovery that address productivity, mortality, and dispersal.

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

According to the US Fish and Wildlife Service (USDI 2003), putting a local lynx population at risk of extinction would require the activity to occur over a large area of several home ranges and include three factors:

1) Cumulatively result in the conversion of lynx habitat into non-habitat.
2) Result in a homogenous forest that does not provide the various stand ages, species composition, and structure.
3) Effectively preclude dispersal.

The proposed Travel Plan would have no effect on the first two factors as no vegetation treatment is being proposed and denning, foraging, and suitability of lynx habitat will remain static before and after the implementation of any of the alternatives. If vegetation treatments (fuel reduction or timber sale projects) occur that impact these habitat features, further NEPA analysis would be required and weighed against the habitat specific programmatic and project level standards and guidelines in the LCAS or NRLA.

The third factor is discussed under Habitat Connectivity and Issue 3: Biological Diversity and Ecological Sustainability. Further cumulative effects are dependent upon activities on adjacent private or other public lands such as land development and increased roads and/or highways. Areas of non-habitat may also play a role in connectivity across landscapes with little to no vegetative cover or attributes conducive to lynx movement.

The Travel Plan alternatives varied in accordance with the emphasis for each alternative theme or resource issue it addressed. Considering the alternative totals by LAU for summer motorized open road density, none of the LAUs in any of the alternatives result in greater than 2.0 mi/sq mi and thus meet the LCAS. These totals reflect both Wilderness and non-Wilderness, and private roads within individual LAUs. The winter use identified parameters (over-the-snow route miles and snowmobile closure areas) were displayed to provide a look at the effect of each alternative's route and area configuration across all LAUs for consideration of the LCAS intent to minimize snow compaction.

Alternative 1

Despite Alternative 1 serving as the 'baseline' for this project, it may add direct, indirect and cumulative effects to the existing situation long-term. Assuming human recreational activities increase in the future, this alternative has the most potential to affect lynx long term. There is no reasonable logistical way to deter an increase in snowmobile use without designating routes and identifying areas open (or closed) to snowmobiles as proposed in Alternatives 2 through 7-M. Snowmobile and ski accessible areas would continue to increase where land topography, snow conditions, and increased technology make it feasible which may contribute to increased snow compaction across the landscape over time. Regardless of the effects that Alternative 1 may have long-term, it is used as a baseline from which to compare all the other alternatives and measure LCAS standards and guidelines.

Alternative 2-4, 6
Alternatives 2-4 and 6 indicate an increase in over-the-snow routes ranging from a net increase of 9 miles (Alternative 2) to 164 miles (Alternative 3). These alternatives also indicated an increase in snowmobile closure area acres of 5,572 acres (Alternative 2) to 399,650 acres (Alternative 6). Although these alternatives have some level of compensatory snowmobile closure area acres that could contribute to consolidating snow compaction within LAUs, not all LAUs meet this requirement. Due to these alternatives not meeting the LCAS standards for winter use, they would adversely contribute to the cumulative effects described above.

Alternative 5 and 7-M
Alternatives 5 and 7-M also indicate an increase in over-the-snow routes ranging from a net increase of 12 miles (Alternative 5) to 75 miles (Alternative 7-M). These alternatives also indicated an increase in snowmobile closure area acres of 356,185 acres (Alternative 5) to 318,427 acres (Alternative 7-M). Meeting LCAS winter use standards may ameliorate the effect of other management activities over time. This is, of course, entirely dependent on the scale and type of project proposed and the predicted effects when given due consideration of current science-based lynx management direction. All of the LAUs in these alternatives meet the LCAS.

Travel Plan Area Proposed Goals, Objectives, Standards and Guidelines

Alternative 1
Alternative 1 is used as a baseline from which to compare all the other alternatives and measure LCAS standards and guidelines. Despite Alternative 1 serving as the 'baseline' for this project, it may add direct, indirect and cumulative effects to the existing situation long-term. However, the current management direction (LCAS, Ruediger 2000) would continue to be followed as per the Conservation Agreement (USDA and USDI 2005).

Alternative 2-6
Implementation of TPA Goal 2 Winter Recreation Use and Objective 2(1) for North Bridgers, West Bridgers North and South, Fairy Lake, Bridger Canyon, and Bangtails (Alternatives 2-4); Yellowstone, portions of Tom Miner-Rock, Gallatin Crest, and Bear Canyon (Alternatives 2, 3); Mill Creek (Alternative 3, 4); Lionhead (Alternative 3); Bozeman Creek, Hyalite, portion of Gallatin Roaded (Alternatives 3, 4); South Plateau (Alternatives 3, 4); Taylor Fork (Alternative 3); Shields, Ibex, portion of East Crazies (Alternative 3, 4, 6); and portions of Gallatin Roaded, Gallatin Crest, and Porcupine Buffalo Horn (Alternatives 3, 4) TPAs may impact lynx as identified by alternative and LAU in the effects section above. In addition, Objective 2(3) and Objective 2(4) for Bozeman Creek TPA; Objective 2(2) for Fairy Lake TPA; Objective 2(2) for Bridger Canyon TPA; and additional plowed roads in the Hyalite TPA through the implementation of Objective 2(2) and Objective 2(4) and Objective 2(5) Hyalite TPA proposal to improve winter passenger vehicle use increase use through additional routes or accessibility which may potentially disrupt foraging, denning, or other movement patterns.

The proposed Standard F-2 specific to lynx would duplicate the current direction in the LCAS. The Gallatin Forest is obligated to manage consistently with the LCAS. This Standard is not necessary to promote that commitment.

Two TPAs (Bear Canyon and Lionhead) include programmatic direction as described in Goal E. Wildlife Corridors, Objective E-1. There are no goals or objectives for potential corridors relative to movement between the Crazy Mountains and the Castle and Little Belt Mountains.

The seasonal restrictions for snowmobiles proposed from October 15 – December 1 to protect wildlife security, erosion control, and recreation conflicts would alleviate some of the impacts to lynx and lynx habitat during the early winter. These restrictions to snowmobiles are proposed throughout the Forest, particularly where late fall hunting activity occurs. Snowmobiles are permitted in these areas after December 1.

Alternative 7-M

Similar to Alternative 2-6, only two TPAs (Bear Canyon and Lionhead) include programmatic direction as described in Goal F. Wildlife Corridors. The potential corridor relative to movement between the Crazy Mountains and the Castle and Little Belt Mountains was added to the proposed Goal F for Migration Corridors but this corridor is not recognized in the Shields TPA programmatic direction. In addition, the North Bridgers TPA does not include programmatic direction for the North Bridgers potential linkage area. A couple potential corridors were dropped from the DEIS Goal E including Yankee Jim Canyon and Cooke Pass which are identified as lynx linkage areas. Additional potential lynx linkage areas not listed in the Goal includes the Crazy Mountains to the Absaroka Mountains area and the Crazy Mountains to Bridger Range area.

No lynx have been documented using these potential corridors and they are not defined explicitly on the ground. Other factors not influenced by the Gallatin Forest activities such as private land development, existing infrastructure, or inherent habitat quality would have a greater impact on these linkage areas. Other than the standard for habitat connectivity, there is no specific direction within a linkage area relative to travel planning. The lack of programmatic direction relative to these identified linkage areas may minimize opportunities for lynx movement long term but does not necessarily preclude the ability to maintain habitat connectivity within the areas on the Gallatin Forest.

Alternative 7-M includes programmatic direction to consider proposals to authorize locations for public recreational aircraft at designated sites. If such proposals are brought forth in the future, consideration of effects to lynx would be made at that time.

There would be no specific programmatic management direction for lynx. The Gallatin Forest would be obligated to meet the current direction for lynx, whether in the LCAS or revised LCAS, until such time that the NRLA supercedes it. Therefore, this direction would be duplicated and not necessary in the programmatic direction section of the Travel Plan.

Similar to Alternative 2-6, the seasonal restrictions for snowmobiles proposed from October 15 – December 1 to protect wildlife security, erosion control, and recreation conflicts would alleviate some of the impacts to lynx and lynx habitat during the early winter.

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

A Conservation Agreement between the Forest Service and the US Fish and Wildlife Service (Agreement #00-MU-11015600-013) committed the Forest Service to use the LCAS when considering the effects of actions on lynx until the Forest Plans are amended (USDI 2005). Currently, the on-going adherence to the Conservation Agreement, the LCAS, and the programmatic biological opinion alleviates the effects of federal land management activities. However, amendment of National Forest Plans to conserve lynx will be the strongest mechanism in ensuring lynx and lynx habitat are conserved on National Forests for the long-term.

For the proposed Gallatin National Forest Travel Management Plan and Forest Plan Amendment, there are several alternatives for some LAUs that do not meet current LCAS management direction for winter over-the-snow activity. Alternatives 5 and 7-M are the only two alternatives wherein all the LAUs meet the intent of the LCAS and are therefore consistent with this management direction.