# Trends in road development and access management in the Cabinet–Yaak and Selkirk grizzly bear Recovery Zones

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***Abstract:*** Unlimited use of forest roads can result in taking of grizzly bears (*Ursus arctos*) and reduced progress toward recovery. We examined trends in road development and motorized access management in the Cabinet–Yaak and Selkirk grizzly bear recovery zones by evaluating 3 bear management units (BMUs) for amount and density of open and total roads and security core habitat during 3 periods (1975, 1987, and 2001). New road construction and access management activities such as road use restrictions, road closures and road decommissioning governed the amount and kinds of roads present. In 1975, nearly all roads were open to public access, but the amount of open roads declined during subsequent periods. Closed roads increased correspondingly, and by 1987, public motorized access was excluded from the majority of roads in some BMUs. Road decommissioning, nonexistent in 1975 and 1987, was common by 2001. Even with new construction, there were fewer open roads in 2001 than in 1987 and 1975 for all 3 BMUs examined. Due to road decommissioning, the total length of roads in 2001 was less than during at least 1 of the 2 previous periods for all BMUs examined. For most BMUs, open motorized route density (OMRD) and total motorized route density (TMRD) peaked in 1987, and security core habitat reached its lowest level during that period. However, access management activities after approval of Forest Plans in 1987 resulted in decreases in OMRD and TMRD and increases in security core habitat. As of 2002, most of the 30 BMUs in the Cabinet–Yaak and Selkirk grizzly bear recovery zones either met or were moving toward recommended OMRD, TMRD, and security core levels. Improved habitat security through reduced open and total road densities and increased security core habitat is likely to assist in limiting grizzly bear mortality and enhancing the likelihood grizzly bears will persist in these recovery zones. Had these improvements in security not occurred, we believe these grizzly bear populations would be even more imperiled than they currently are.

***Key words:*** bear management unit, Cabinet–Yaak, grizzly bear, mortality, open road density, security core habitat, Selkirk, total road density, *Ursus arctos*

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Roads on National Forest System lands are important for natural resource extraction, fire suppression, public recreation, and other legitimate multiple uses. The extensive network of roads within National Forests was developed over more than 100 years. The development of efficient mechanized logging equipment coupled with post-World War II society's increasing demand for wood products greatly accelerated forest road construction during the second half of the 20th century. During this period of heightened road construction, an awareness of the effects of roads on wildlife began to develop. These potential negative effects of roads affect many wildlife species, including the grizzly bear, a threatened species south of Canada under the U.S. Endangered Species Act (ESA; 16 U.S. Code 1531–1544). Human motorized use of forest roads can result in taking of grizzly bears (U.S. Fish and Wildlife Service [USFWS] 1995) and can reduce progress toward recovery of the species. The management of roads to reduce these impacts has been called the most powerful tool available to balance the

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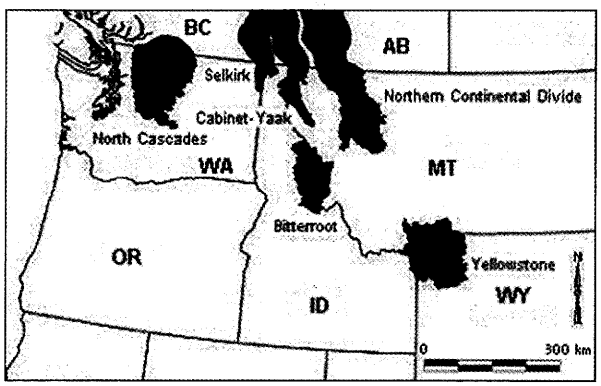


**Fig. 1. Grizzly bear recovery zones in the northwestern continental U.S., 2003.**

needs of bears with the activities of humans (USFWS 1993).

We examined trends in forest road development and management of motorized vehicular access on National Forest lands in portions of the Cabinet–Yaak and Selkirk grizzly bear recovery zones. These recovery zones have small grizzly bear populations determined to warrant uplisting to endangered species status under ESA (USFWS 1999).

The U.S. Department of Agriculture Forest Service manages the largest land base in grizzly bear habitat in the conterminous United States. Our analysis of roads and access management evaluates the agency's efforts on 2 National Forests to manage grizzly bear habitat in a manner consistent with the species' recovery objectives.

## Study area

Our study area encompassed portions of the Idaho Panhandle and Kootenai National Forests in northern Idaho and northwestern Montana. These areas are in the Selkirk (approximately 5,700 km$^2$) and Cabinet–Yaak (approximately 6,700 km$^2$) grizzly bear recovery zones (Fig. 1). Topography ranges from a low elevation of 550 m in the valley bottoms to about 2,450 m in the Selkirk, Cabinet, and Purcell mountain ranges. The climate has a distinct Pacific maritime characteristic, including warm, dry summers and wet winters with abundant snowfall. Annual precipitation ranges from about 50 cm in the lower valley bottoms to over 200 cm on the highest mountain peaks. Dense forests dominate the landscape, including ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) on the lower, drier slopes and western red cedar (*Thuja plicata*) and western hemlock (*Tsuga heterophylla*) on the lower, moist slopes.

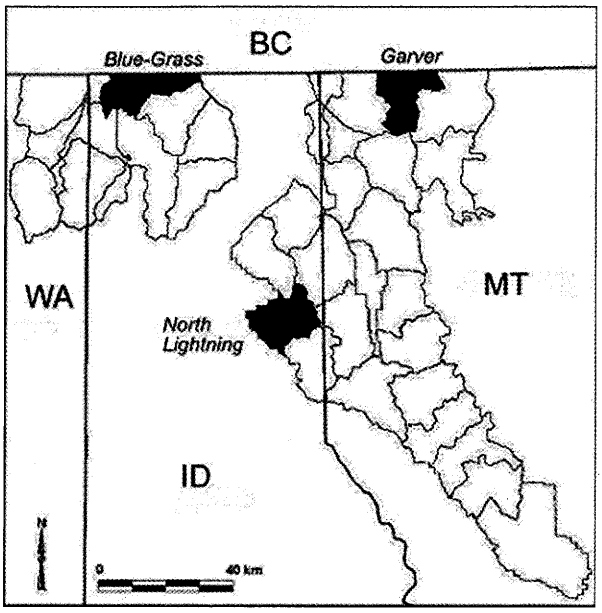


**Fig. 2. Bear management units in the Selkirk and Cabinet–Yaak grizzly bear recovery zones.**

A mixed coniferous forest, including western larch (*Larix occidentalis*), western white pine (*Pinus monticola*), and lodgepole pine (*Pinus contorta*), exists on mid-slopes, and stands of subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), and whitebark pine (*Pinus albicaulis*) dominate at the upper elevations.

A network of roads emanates from the valley bottoms for accessing these forested lands. Much of the area has roads, but some federally-designated wilderness and roadless lands remain, particularly at higher elevations. Vegetative changes resulting from timber harvest in association with this road network are common across the landscape. Many of these logging roads are closed to public access, and some have been restored to a semi-natural condition through road decommissioning.

## Methods

Grizzly bear recovery zones are divided into bear management units (BMUs) to facilitate analysis and management (U.S. Forest Service [USFS] 1990). We selected 3 BMUs as case examples out of the 30 BMUs in the recovery zones: the Garver and North Lightning BMUs in the Cabinet–Yaak recovery zone and the Blue-Grass BMU in the Selkirk recovery zone (Fig. 2). We selected these BMUs because historical road data could be reconstructed, current road data were available, and these BMUs are spatially distributed throughout the

recovery zones (one each in the Selkirks, Cabinets, and Purcells). Land and Resource Management Plans (Forest Plans, hereafter) have been in place on these National Forests since 1987 (USFS 1987*a*,*b*).

We obtained historical and current data on roads in several management categories from maps and other records at Idaho Panhandle and Kootenai National Forest offices and from interviews of National Forest employees. The mapped road data were at the 1:24,000 scale. Road categories include:

***open roads*** — open to all motorized vehicular access.

***restricted roads*** — open to motorized access by authorized agency personnel, their permittees, and contractors. Access is generally restricted with gates.

***closed roads*** — closed to all motorized vehicular access, generally with barriers.

***total roads*** — the sum of open, restricted, and closed roads.

***decommissioned roads*** — roads that have been reclaimed, are no longer useable by motorized vehicles, and are removed from the road system. They are no longer considered roads.

We combined the restricted and closed road categories into a single group called "closed roads" to simplify the analysis and because both categories similarly affect public access.

We collected data for 3 periods: (1) 1975, the year grizzly bears were listed as threatened under the Endangered Species Act, (2) 1987, the year Forest Plans were completed for these National Forests, and (3) 2001, the most recent year for which data were available. On the Kootenai National Forest, 1975 data were unavailable so 1978 data were substituted.

We used ArcInfo® (Environmental Systems Research Institute, Redmond, California, USA) geographical information system (GIS) to assess and visually display the densities of open (OMRD) and total (TMRD) motorized route densities within the BMUs. Motorized routes typically include both roads and motorized trails (Interagency Grizzly Bear Committee [IGBC] 1998); however, motorized trails are inconsequential in the 3 BMUs examined, so we considered only roads in this analysis.

We assessed OMRD and TMRD with a "moving window" technique first applied to grizzly bear habitat by Mace et al. (1996). We used the specific moving window protocol for the Cabinet–Yaak and Selkirk recovery zones (W. Wakkinen and W. Kasworm, 1997, Grizzly bears and road density relationships in the Selkirk and Cabinet–Yaak recovery zones, Interagency Grizzly Bear Committee, Libby, Montana, USA). This protocol uses a 1-mile$^2$ (2.6 km$^2$) approximately circular "window" that is moved across each 30 × 30 m pixel on a map, calculating the road density within the 1-mile$^2$ area surrounding the pixel. These calculations are then aggregated for the BMU to provide OMRD and TMRD. This methodology expresses OMRD and TMRD as the percent of a BMU exceeding a specified road density level. OMRD is expressed as the percent of the BMU exceeding 1 mile/mile$^2$ of open roads. TMRD is expressed as the percent of the BMU exceeding 2 miles/mile$^2$ (Wakkinen and Kasworm unpublished report 1997). We used English units for these parameters because the National Forests use this method to monitor road densities and because the data reported by these National Forests are in English units. Road densities calculated in English units using the moving window technique cannot be converted to metric units. Our methodology is consistent with the Wakkinen and Kasworm (unpublished report 1997) protocol.

We also examined security core habitat in each BMU with a standard GIS buffering routine. Security core habitat is defined as area >500 m from an open or gated road (IGBC 1998). OMRD, TMRD, and core habitat are currently recognized as the best available measures of the effects of motorized access on grizzly bears (IGBC 1998).

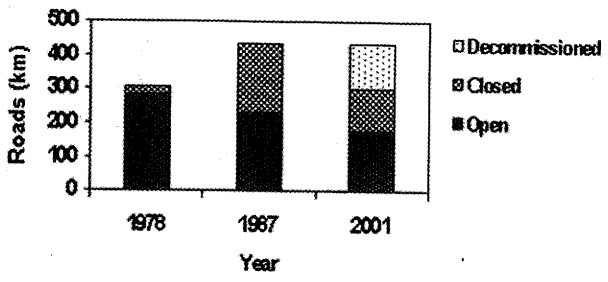


**Fig. 3. Kilometers of open, closed, and decommissioned roads in Garver bear management unit, Cabinet–Yaak grizzly bear recovery zone, Montana, USA.**

## Results

### *Quantity of roads*

New roads were constructed during each of the 3 periods. Road closures and road decommissioning occurred simultaneously with construction, and the relative amounts of each determined the quantity and status of roads on the landscape.

Within Garver BMU, open roads decreased 18% (283 km to 233 km) from 1978 to 1987. An additional decrease of 24% (233 km to 177 km) occurred between 1987 and 2001. Closed roads in Garver BMU increased

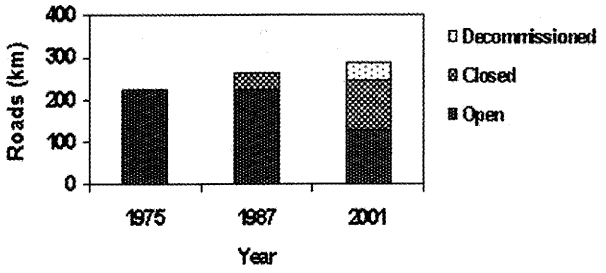


**Fig. 4. Kilometers of open, closed, and decommissioned roads in North Lightning bear management unit, Cabinet–Yaak grizzly bear recovery zone, Idaho, USA.**

840% (24 km to 203 km) during 1978 to 1987. From 1987 to 2001, however, the amount of closed roads decreased to 127 km. This reduction was the result of road decommissioning that removed 132 km of closed roads. Road decommissioning was done for a variety of purposes, such as watershed restoration and reduction of road maintenance costs, in addition to improving grizzly bear habitat security (USFS 2002*a*). By 2001, the amount of open and closed roads in Garver BMU was less than in either 1978 or 1987 (Fig. 3).

The amount of open roads in North Lightning BMU remained constant at 224 km from 1975 to 1987. Between 1987 and 2001, open roads decreased 42% (224 km to 130 km). Closed roads in North Lightning BMU increased from zero in 1975 to 39 km in 1987. From 1987 to 2001, closed roads increased an additional 196% (39 km to 114 km). Road decommissioning removed 43 km of roads from the BMU between 1987 and 2001. In 2001, the amount of open and closed roads in the BMU was 9% greater than existed in 1975, but 7% less than existed in 1987 (Fig. 4).

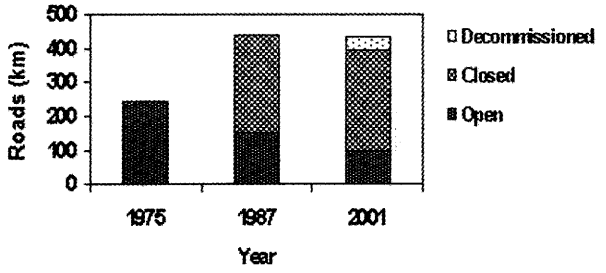


**Fig. 5. Kilometers of open, closed, and decommissioned roads in Blue-Grass bear management unit, Selkirk grizzly bear recovery zone, Idaho, USA.**

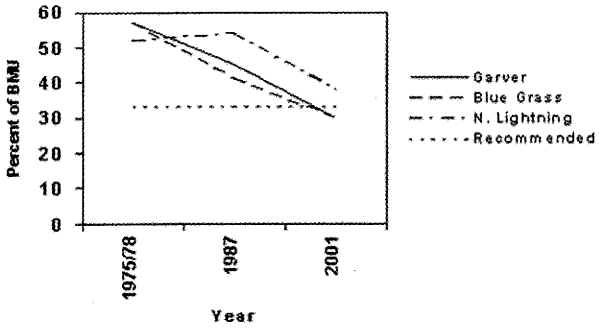


**Fig. 6. Open motorized route density (OMRD) in Garver, North Lightning and Blue-Grass bear management units compared to the recommended level of 33%.**

Open roads in Blue-Grass BMU declined 38% (245 km to 151 km) during 1975 to 1987. A further decrease of 35% (151 km to 98 km) occurred between 1987 and 2001. Closed roads in Blue-Grass BMU increased from zero in 1975 to 287 km in 1987. A 3% increase in closed roads (287 km to 296 km) occurred between 1987 and 2001. Road decommissioning eliminated 42 km from Blue-Grass BMU between 1987 and 2001. In 2001, the total amount of roads (open and closed) existing in the BMU was 61% higher than in 1975, but 10% less than existed in 1987 (Fig. 5).

### *Open and total motorized route density and security core habitat*

Wakkinen and Kasworm (unpublished report 1997) suggested that to maintain grizzly bear populations in their study areas, OMRD and TMRD levels should not exceed 33% of a BMU greater than 1 mile/mile$^2$ and 26% of a BMU greater than 2 mile/mile$^2$, respectively. They based their recommendations on average values

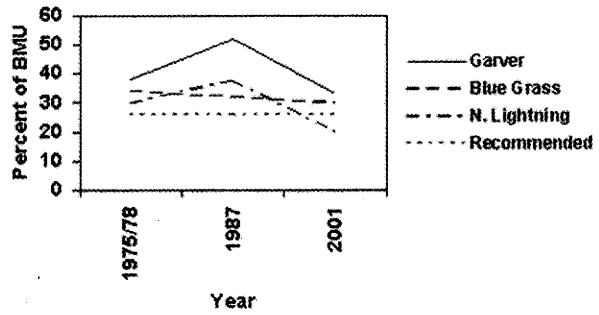


**Fig. 7. Total motorized route density (TMRD) in Garver, North Lightning and Blue-Grass bear management units compared to the recommended level of 26%.**

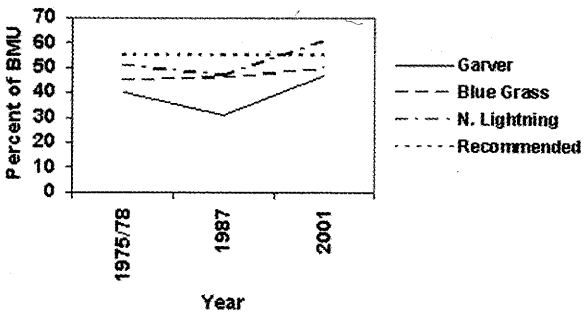


**Fig. 8. Security core habitat in Garver, North Lightning and Blue-Grass bear management units compared to the recommended level of 55%.**

for adult female grizzly bears with home ranges in the Cabinet–Yaak and Selkirk areas.

OMRD declined steadily in Garver and Blue-Grass BMUs during the 3 periods examined. OMRD increased slightly in North Lightning BMU from 1975 to 1987, but declined sharply from 1987 to 2001 (Fig. 6).

TMRD declined steadily in Blue-Grass BMU throughout the 3 periods. TMRD peaked in Garver and North Lightning BMUs in 1987 and declined through 2001 (Fig. 7).

Security core habitat showed essentially the inverse trend of TMRD during the 3 periods. Security core declined in Garver and North Lightning BMUs between 1975 (1978) and 1987 but then increased through 2001. In Blue-Grass BMU, security core increased throughout the 3 periods (Fig. 8). Wakkinen and Kasworm (unpublished report 1997) suggested a minimum of 55% security core habitat. Changes in security core habitat in Garver BMU (Fig. 9) through time were similar to changes in the Blue-Grass and North Lightning BMUs.

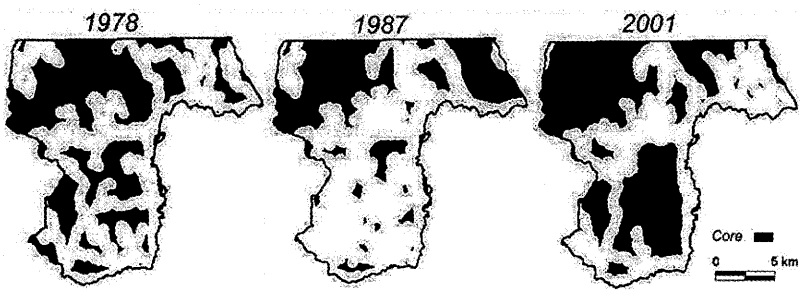


**Fig. 9. Security core habitat in Garver bear management unit, Cabinet–Yaak grizzly bear recovery zone.**

## Discussion

Grizzly bear habitat as influenced by open roads, and to a lesser extent by total roads, is more secure in the 3 BMUs we examined than at any time in the past 25 years. We believe that habitat security for bears throughout the Cabinet–Yaak and Selkirk recovery zones declined during the late 1970s and 1980s as road construction and timber harvesting on the National Forests peaked. Forest Plans approved in 1987 included direction to manage roads in ways that improve security for grizzly bears and other wildlife (USFS 1987*a*,*b*). Habitat security has improved in the 3 BMUs we examined and in most other BMUs during implementation of these plans (Appendix, USFS 1998, 2002*a*). Although we did not quantify this, we believe that road access trends in the 27 BMUs throughout the recovery zones that we did not examine are broadly similar to the trends in the 3 BMUs we did examine. Data on quantity of roads, road densities, and road-related habitat effectiveness collected during implementation of the Forest Plans support our belief (USFS 1998, 1999, 2000, 2001, 2002*a*,*b*; Appendix).

Whether current security is sufficient to sustain bear populations is unknown. But it is likely that conditions will be conducive to bear survival where OMRD, TMRD, and core habitat are managed at the levels suggested by Wakkinen and Kasworm (unpublished report 1997). These suggested OMRD, TMRD, and security core habitat levels are based on the average of habitats used by female bears that were successful at surviving to adulthood within these recovery zones. Only one of their sample bears deviated more than 10% from the average OMRD, TMRD, or security core habitat available within home ranges of the study animals. She successfully produced 2 litters but has not been observed since 1997 (Kasworm et al. 2002). The majority of grizzly bear mortalities in the Cabinet–Yaak and Selkirk recovery zones have been human-caused. Most of these human-caused mortalities have been within 500 m of open roads on public lands (USFS 2002*c*).

Each of the 3 BMUs examined either meets or is moving toward meeting suggested OMRD, TMRD, and core habitat levels. In 2001, the OMRD, TMRD, and core recommendations of Wakkinen and Kasworm (unpublished report 1997) were met or exceeded in 67%, 50%, and 63%, respectively, of the 30 BMUs in the Cabinet–Yaak and Selkirk recovery zones (Appendix). The Kootenai, Idaho Panhandle, and Lolo

National Forests have proposed management direction to further improve habitat security for grizzly bears in the Cabinet–Yaak and Selkirk recovery zones (USFS 2002*c*).

Having management direction in place does not in itself ensure that the direction is effectively implemented. For example, claims have been made that road closure devices (such as gates and berms) are poorly managed and maintained, and thus ineffective (Platt 1993, Havlick 1999). However, each National Forest in the Cabinet–Yaak and Selkirk recovery zones has programs for controlling administrative use of gated roads, for monitoring and enforcing road closures, and for repairing gates and other closure devices damaged by vandalism.

Population estimates characterized as conservative for the Cabinet–Yaak and Selkirk recovery zones were 30–40 bears for the Cabinet–Yaak recovery zone (Kasworm et al. 2002:39) and 46 bears for the Selkirk recovery zone (USFWS 1999:26731). Population trends for both recovery zones were statistically inconclusive (USFWS 1999, 2001), a situation difficult to avoid given the small population sizes. During 1983–2002, Wakkinen and Kasworm (2004) calculated $\lambda = 0.964$ (95% CI = 0.844–1.063) for the Cabinet–Yaak and $\lambda = 1.019$ (95% CI = 0.922–1.098) for the Selkirks. Some anecdotal evidence suggests both these populations may be slowly increasing. This evidence includes increasing numbers of sightings (W. Kasworm, U.S. Fish and Wildlife Service, Libby, Montana, USA and W. Wakkinen, Idaho Department of Fish and Game, Bonners Ferry, Idaho, USA, personal communication, 2003) and expansion of bears into areas not previously known to be occupied (USFS 2002*d*). The available data on mortality and population trends are inadequate to determine whether these parameters have been influenced by reduced motorized access. Other studies have identified the effects of forest roads on grizzly bears and the important role limiting motorized access plays in grizzly bear conservation (McLellan and Shackleton 1988, Mace et al. 1996, Wielgus et al. 2002). We believe that had reductions in motorized access not occurred in the Cabinet–Yaak and Selkirk recovery zones, these grizzly bear populations would be even more imperiled than they currently are.

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