



Saving a Place for America's Predators

**Predator Conservation Alliance's Literature Summary —
Draft — January 24, 2001 — Draft
Conservation Status and Needs of the Wolverine (*Gulo gulo*)**

Part I. Conservation status of the wolverine

- A. Current and historic wolverine distribution and numbers nationwide
- B. Protected status of the wolverine

Part II. Ecological factors limiting the survival and recovery of wolverines in North America

- A. Large range requirements
- B. Dispersal and movements
- C. Low population densities
- D. Low reproductive rates

Part III. Science-based policies needed to protect and restore the wolverine and its habitat throughout the U.S. lower 48.

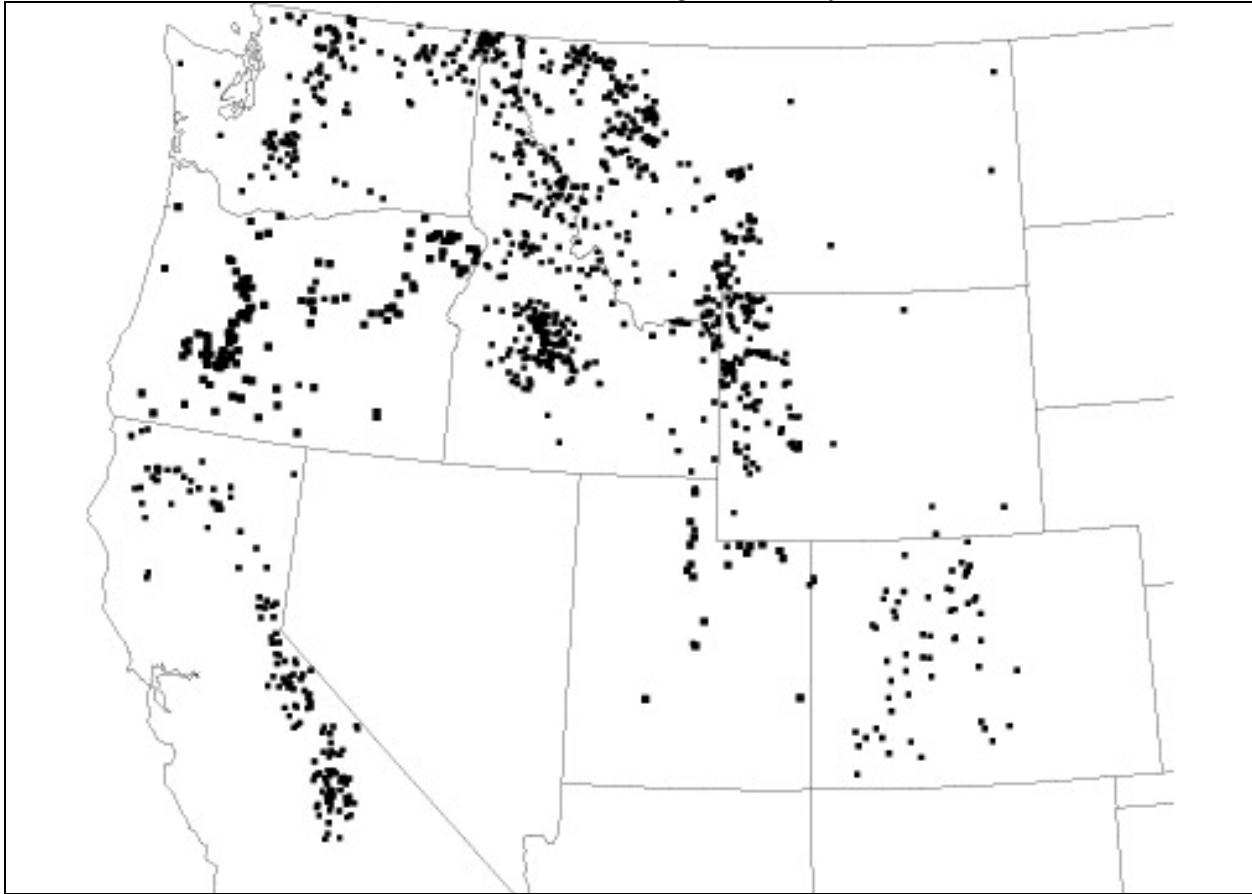
- A. Forest practices, access, and recreation
- B. Trapping
- C. Connectivity vs. Fragmentation

Part I. Conservation Status of the Wolverine

All recorded wolverine observations (ca. 1900 to present)

Compiled by Predator Conservation Alliance, Jan. 2001

Data Sources: CA, ID, MT, OR, WA, and WY Heritage data; Maj and Garton 1994



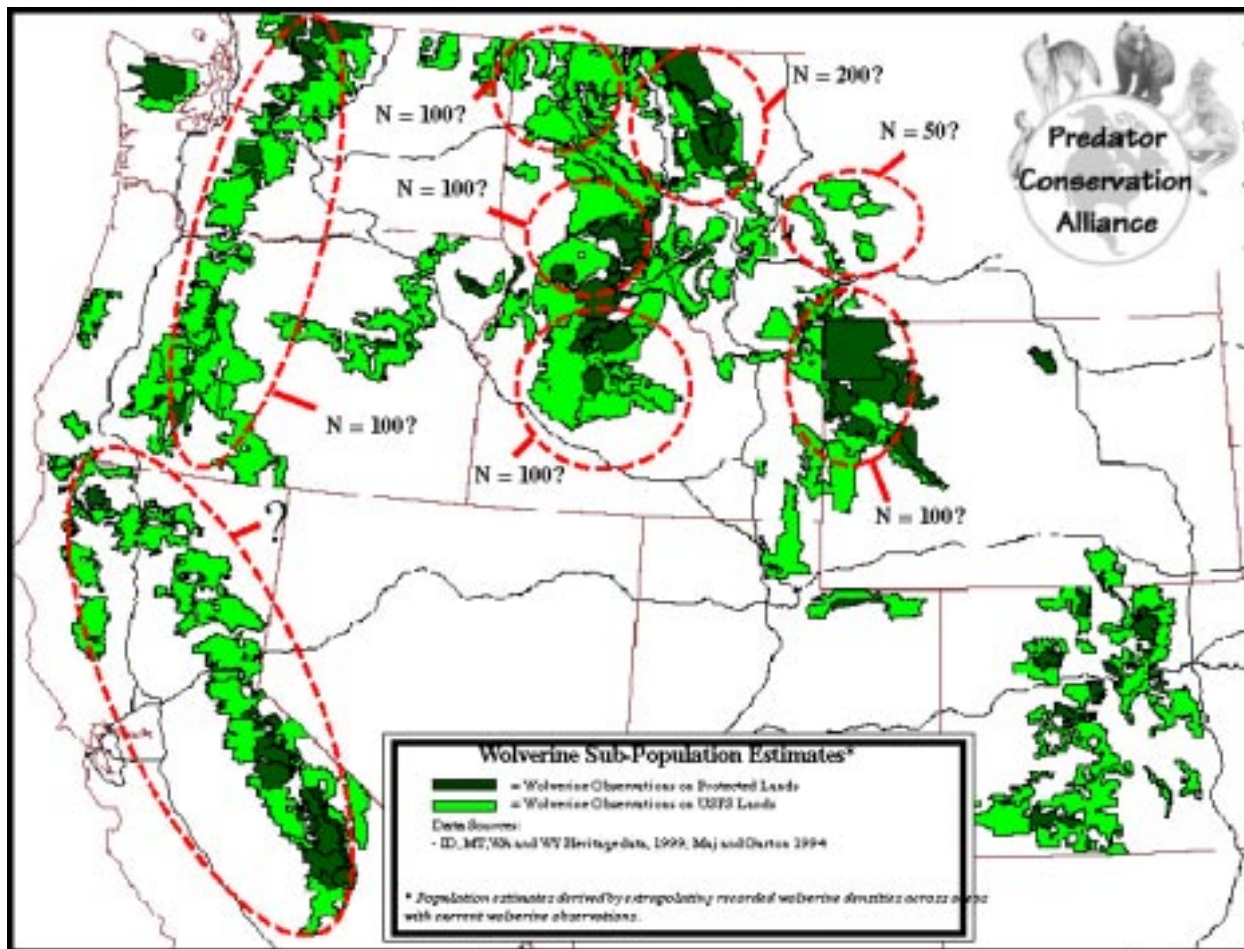
A. Current and historic wolverine distribution and numbers nationwide

Wolverines historically occupied the northern and high-elevation forests of the lower-48 states along the West Coast (Cascades and Sierra Nevada Ranges), Rocky Mountains (Canada border south into Arizona and New Mexico), the Lake States and Northeast. Data on current wolverine distribution and numbers in the contiguous United States is not comprehensive, but there is scientific consensus that: (1) wolverine range and numbers have decreased dramatically since pre-Columbian times due to human activities and developments, (2) wolverines currently number fewer than 1,000 across the lower-48 states, and (3) these occur in populations that are increasingly fragmented and isolated both from each other and from wolverine populations in Canada.

At the continental scale, wolverines are now believed to be extirpated from the entire northern tier of the contiguous United States except the northern Rocky Mountains and portions of the Northwest, and extirpated across the southern region of Canada from the Atlantic west to the

Canadian Rockies (e.g., Hash, 1987). Within the contiguous United States, the best available information indicates that current wolverine range has been reduced to small, fragmented populations in the northern Rockies and Northwest (western Montana, Idaho, Washington State, Oregon and Wyoming), although remnant populations may persist in the south-central Rockies (Colorado, Utah), the Sierra Nevada Range, the Lake States (Michigan) and possibly the Northeast (Maine). There are few estimates of wolverine numbers in the published literature, but extrapolating from the best available information indicates an estimated population of fewer than 750 wolverines in the lower 48, including an estimated 400-600 in the U.S. northern Rocky Mountains, and perhaps 100 across the Northwest and Sierra Nevada.

Predator Conservation Alliance's estimated wolverine numbers in the western U.S.



1. Northern Rockies and Northwest

a. Overall

Estimated wolverine distribution and numbers are as follows:

- **Montana**—An estimated 300 wolverines are fragmented between three populations centers and are found in outlying mountain ranges where they are not known to be viable;

- **Idaho**—perhaps 300 wolverines persist, based on research and sightings concentrated in south-central Idaho (Sawtooth, Smoky Ranges), north-central Idaho (Lochsa, Kelly Creek Drainages), and northern Idaho (Selkirk Mountains);
- **Wyoming**—perhaps 50 wolverines present, based on sightings in western Wyoming from Yellowstone National Park east along the Absaroka Range and south into the Wind River and Salt River Ranges;
- **Washington/Oregon**—perhaps 100 present, scattered across the Cascades of Washington and Oregon.

b. Montana

The last remaining population "stronghold" for wolverines in the lower-48 states is in western Montana and portions of neighboring Idaho. Sighting data compiled by biologists under contract to the interagency Western Forest Carnivore Committee (Maj and Garton, 1994) and updated by the Montana Natural Heritage Program, indicate that wolverines have re-colonized most of the mountain ranges in western Montana since their historic lows in the 1920s, yet their distribution may be once again in decline.

The site of the only wolverine field study in Montana (Hornocker and Hash, 1981), wolverines are known to occupy the Swan Range and adjacent portions of the Flathead National Forest south of Glacier National Park. Hornocker and Hash (1981) captured 24 wolverines in their study over a period of four years and estimated a minimum population size of 20 wolverines within the 13200 km² area, or one wolverine per 65 km². They asserted that their data indicated a stable wolverine population "on the study area proper," but because of the high mortality rates they added, "dispersal may be acting to maintain that stability" (p.1297). Presumably the researchers were referring to dispersal from Glacier National Park and Canada at the northern boundary of their study area. Due to escalating human activities along transportation corridors between areas of secure wolverine habitat, this type of dispersal is increasingly in jeopardy (e.g., Highway 2 south of Glacier National Park; Ruediger et al. 1999).

Other published reports of wolverine distribution over time indicate a rebounding from near-extinction in Montana from 1920 to 1940, to their current distribution across much of western Montana, including the Bear Paw Mountains south of Havre and the Sweetgrass Hills, 100 miles east of Glacier National Park (Newby and McDougal, 1964, Newby and Wright, 1955). At the time of their writing in 1955, Newby and Wright concluded that "the wolverine is not at present threatened with extinction but instead may be increasing its numbers and repopulating its range in Montana" (p. 253). Yet, they qualify their optimism with this caveat:

"However, extensive logging operations have made rapid inroads into many areas of excellent wolverine habitat. ...If this situation continues our protected wilderness areas and National Parks will be the only areas remaining with suitable habitat for animals such as the wolverine. ..." (p. 253).

Logging of National Forest lands began in earnest in the 1960s and may be responsible for an apparent decline in wolverines since that time.

Montana Department of Fish, wildlife and Parks personnel assert that wolverine populations in Montana are stable or increasing (B. Giddings, pers. comm., 1999), but there is a lack of reliable data to support this claim. Montana still allows a trapping season, but there are too few data to be able to detect trends or to ensure that this trapping is sustainable. The data does indicate a decline from 25 wolverines trapped in 1984 to an average of about half that number over recent years, a very low number considering that the season is open for ten weeks with no statewide quota.

c. Idaho

As in Montana, data on wolverine sightings in Idaho were compiled by biologists under contract to the interagency Western Carnivore Committee (Maj and Garton, 1994) and are updated by the Idaho Conservation Data Center. The data indicate that wolverines appear to be well distributed across National Forest lands in Idaho.

The scientific literature provides some added refinement to the sightings data. Wolverines are known to occupy portions of the Sawtooth, Challis, and Boise National Forests in central Idaho, the site of the only other field study done on wolverines in the lower 48 states, by Idaho Department of Fish and Game researcher Jeff Copeland (1996). Copeland (1996) captured a total of 19 wolverines and was fairly confident that he had trapped all of the wolverines within his study area (p. 30). This provided a density of one wolverine per 90-248 km² (p. 32). Copeland did not determine or even speculate about whether the wolverine population within his study area was stable.

Idaho Department of Fish and Game conducted surveys to estimate the distribution of wolverines in Idaho (Groves, 1988). The survey resulted in "10 confirmed and 89 probable reports of wolverines in Idaho between 1967 and 1987" (p. 181). The sightings were concentrated in at least three areas in Idaho: the Selkirk Mountains in northern Idaho, the Lochsa and Kelly Creek drainages in north-central Idaho, and the Sawtooth and Smoky Mountains in south-central Idaho (p. 181). In his survey, Groves (1988) did not speculate on whether or not current wolverine populations in Idaho were stable. "[R]esults of this survey can offer no insights to the viability of wolverine populations in Idaho" (p. 184). Groves states that wolverines may be increasing in Idaho, "because more than half of the wolverine reports compiled during this survey occurred between 1980 and 1997" but qualifies this by saying, "such a conclusion may be misleading" (p. 184). As explanation, Groves refers to a Washington State study where observer effort and

access to wolverine habitat has increased over time, and he notes that no surveys have ever been done before in Idaho.

d. Wyoming

Wolverine sightings have been well-distributed across northwestern Wyoming, but they may no longer occur in the Wind River and Gros Ventre Ranges, because there have been no recent sightings during the 1990s in those areas. Curiously, these data include a 1991 sighting in the Medicine Bow Mountains on the southeast border of the state, but the Wyoming Department of Game and Fish has not been able to assess its reliability. Additional reported sightings include two wolverines seen by Wyoming Game and Fish personnel in 1980, and a 38-pound male trapped on Horse Creek. Recent surveys by WGFD biologists for wolverines and lynx have revealed a few signs of wolverines on the Shoshone and Bridger-Teton National Forests:

"One set of tracks was observed in Robinson Creek on the South Fork of the Shoshone River in the winter survey for 1996/97, additional reports in the past few years from the upper North Fork of the Shoshone River drainage, Blackwater Creek, and Republic Creek... No additional evidence of wolverines was obtained for the Forest during 1997/8 snow machine winter survey period. Information gathered for this species on the Forest during the past decade indicates a continued presence but apparently at very low numbers and scattered distribution." (USDA 1999, p. 53)

In response to Predator Conservation Alliance's wolverine range map and population estimates above, Wyoming Game and Fish Biologist Bob Luce provided some additional evidence that wolverines are rare in Wyoming (E-mail correspondence to David Gaillard, January 24, 2000):

"During lynx track surveys our personnel covered much of the potential wolverine range in the Wind River Range in Wyoming. We documented only a couple of wolverine. Even with a few reliable random observations I would say that an estimate of 100 for Wyoming is way high..."

The scientific literature provides some added information. According to Banci (1994), the species was believed to be near extirpation in Wyoming in the 1920s; however, she reports,

"Newby and McDougal (1964) believed the wolverine had expanded their range into the southwestern part of the state, as did Hoak et al. (1982). There are 100 records available from 1961 to 1991, all in the western third of the state (unpublished data in Maj and Garton 1992)" (p. 103).

Hoak, Weaver, and Clark (1982) reviewed historical literature on wolverine distribution in Wyoming and presented 50 new wolverine reports for western Wyoming, not including Yellowstone Park. These sightings are located in Grand Teton National Park as well as on and adjacent to Shoshone and Bridger-Teton National Forest lands from Yellowstone Park south as far as the southern Salt River and Wind River Ranges. They note an "apparent increase of reports" but do not attribute this to expanding wolverine numbers: instead, these reports "may

reflect increased human use of remote areas, an extension of wolverine range, or both" (p. 160). As for the overall stability of the wolverine in Wyoming, the authors merely conclude, "its status in western Wyoming remains uncertain" (p. 159).

e. Washington

Sighting data compiled by Maj and Garton (1994) indicate that wolverines have been rare, but well-distributed across Washington in recent decades. They report 1990s sightings in Mt. Baker National Forest and on the Olympic Peninsula. Also, the Forest Service is currently conducting aerial surveys for wolverines in Washington and Oregon. These surveys have confirmed tracks on the Okanogan National Forest and found possible wolverine sign on the Wenatchee National Forest in Washington (Rybak 1999).

As mentioned above, trapping records from the early nineteenth century indicate that wolverines were once abundant in Washington: "the Hudson's Bay Co. trapping records from 1836-1853 include 686 wolverine pelts that were obtained at posts in Washington" (Letter, Allen to Jensen, February 3, 1999). The same official reported that the wolverine was probably nearly "extirpated from the state by the early 1900s" Yet the respondent noted some evidence of a partial comeback in recent decades:

"There are 28 records for the state for the period from 1970-1990. Recent aerial surveys detected 3 winter dens, and sight, track, and photo records reported in recent years indicate that wolverine are present in low numbers" (Letter, Allen to Jensen, February 3, 1999).

Thus, current evidence indicates that the wolverine is rare but present in Washington, and if the possible natal den sightings are correct, they reproduce. Other evidence is consistent with these claims. Dalquest (1948) regarded the wolverine as one of Washington's rarest mammals. According to Banci (1994), "Johnson (1977) suggested that wolverines were present in the Cascade Range between 1890 and 1919) but absent or rare throughout the state from 1920 through 1959" (p. 103). Twenty-eight wolverines were recorded for the state between 1970 and 1990 (p. 103).

f. Oregon

Wolverine status in Oregon appears to be similar to its status in Washington: rare, but sightings from recent decades are distributed across the state.

According to Banci (1994), "Kebbe (1996) referred to unverified reports that indicated that a remnant population existed in remote areas of the Cascade Range. ...There are 23 records from 1981 to 1992, compared to 57 records from 1914 to 1980" (p. 103).

Sightings data compiled by Maj and Gorton (1994) reveals 1990s sightings in the Wallowa-Whitman National Forest in the northeastern part of the state and in the Umpqua National Forest in the southern Cascades. The Forest Service's recent aerial surveys for wolverines in Oregon confirmed tracks on the Wallowa-Whitman National Forest and possible wolverine sign was observed on the Umpqua, Malheur, Deschutes, Rogue, and Fremont National Forests (Rybak 1999).

In response to PCA's wolverine range map and population estimates, U.S. Forest Service Biologist Dr. Keith Aubry provided some additional evidence that wolverines are rare in Washington and Oregon (Letter, Aubry to Gaillard, January 25, 2000):

"Wolverine records are especially rare in Oregon... there have only been 5 verifiable wolverine detections in WA since 1986 and only 2 verifiable records from Oregon during this time, one incidentally trapped in 1986 and another found dead in 1992. ...I have been involved in remote camera surveys for wolverine with biologists from the Rogue River NF and Elaine [Rybak] and Bob [Naney] have been involved in helicopter surveys for wolverine throughout the Cascade Range of WA and OR, and despite a concerted and extensive effort, thus far we have only been able to verify the presence of wolverine in north Cascades of Washington."

2. Sierra Nevada Region

There have been no confirmed reports in the Sierra of California and Nevada in the past decade, but periodic sightings are reported.

a. California

According to Banci (1994), the wolverine was believed to be near extirpation by the 1920s, but since then has partially recovered.

"Yocum (1973) believed that wolverines were becoming established in the mountainous areas of northwestern California, from 'surviving nuclei' to the north. The current range includes a broad arc from Del Norte and Trinity counties through Siskiyou and Shasta counties, and south through the Sierra Nevada to Tulare County" (p. 103).

This is consistent with evidence cited by White and Barrett (1979) who estimated a population of 50-100 wolverines in the state.

Sightings data since the 1970s appear to indicate a significant decline in wolverine abundance and distribution in California. These data, compiled by Maj and Gorton (1994), reveal sightings well-distributed across the state up until the 1980s, but there appears to be a paucity of more recent sightings. These authors' records indicate zero records from the 1990s and only three records from the 1980s, concentrated in the southern Sierra (in or near the Sequoia and Inyo National Forests). A recent Oregon Department of Fish and wildlife publication concurs, stating:

"there are no recent positive records from California, despite a concerted effort using photographic bait stations" (ODFW 1996). A recent review of the conservation status of wolverines in California provides added testimony to its current imperiled status (Barrett et al., 1994):

"Since 1970, the number of sightings reported to the California Department of Fish and Game (CDFG) has declined, and no sighting has been verified. In fact, there has been no specimen found nor photograph taken of a wolverine in California for more than 50 years. A research effort conducted cooperatively by the CDFG and the University of California at Berkeley attempted to locate wolverines by means of photographic bait stations, but none of the animals were photographed in either the winter of 1991-1992 or 1992-1993." (p. 93)

The same publication notes that the wolverine was classified as a rare species in California in 1971, and later classified as threatened.

In response to Predator Conservation Alliance's wolverine range map and population estimates above, U.S. Forest Service Biologist Bill Zielinski provided some additional evidence that wolverines are rare in California, but restoration is important and feasible (E-mail correspondence, Zielinski to Gaillard, December 17, 1999):

"Every year there are a few believable but unconfirmed sightings of wolverine in California. California is part of the historic range of wolverine in North America and needs to be retained in any successful conservation plan for the wolverine. ...The confirmed record in so. Oregon, alone, gives us optimism that long-range movement of wolverines in Oregon will lead to recolonization of California."

b. Nevada

There is a lack of information on past and present wolverine distribution in Nevada. A response to an inquiry to the Humboldt-Toiyabe National Forest is indicative: "This Forest has no wolverines, no research, and no management specifications." Yet it also mentions that there are "Historical, pre-1900, reference sightings of 'skunk bears' in northeast Nevada" (Letter, Anderson to Jensen, November 3, 1998).

Nevada was excluded from the Maj and Garton's (1994) compilation of wolverine observations and from Banci's (1994) assessment of wolverine status and conservation needs. Potentially suitable habitat in Nevada that borders occupied wolverine habitat, California to the west and Oregon and Idaho to the north, indicates that wolverines are likely to occur in Nevada, but their status is unknown.

3. Southern Rockies Region

The wolverine is no longer considered viable in Colorado, Utah, and New Mexico, but periodic sightings are reported.

a. Colorado

Sightings data compiled by Maj and Garton (1994) indicate that wolverines have been well-distributed across Colorado. Recent sightings are extremely rare and are limited to the White River and Pike National Forests. Banci (1994) expressed concern that the California population may be becoming isolated and that this has already occurred for wolverines in Colorado: "Wolverines in the Colorado Rocky Mountains ecoprovince are isolated from areas to the north by the Central Rocky Mountain and Wyoming Basins" (p.104). Colorado has recently proposed a wolverine reintroduction program, pending the success of a similar program now underway for the lynx (Colorado Division of Wildlife et al. 1998).

b. Utah

As in Nevada, there is a lack of information on wolverine presence in Utah. Maj and Garton (1994) excluded Utah from their compilation of sightings records as did Banci (1994) in her assessment.

The Utah Natural Heritage description of the wolverine, classed as G4, S1, is given in an unidentified copy of an article, which is specific to the wolverine in Utah:

"Possibly extirpated from Utah, but believed, based on recent (1990) sightings that are judged to be reliable, to be extant in the state. Recent evidence suggests that the species is still present in parts of the Wasatch Mountains, the Uinta Mountains, and mountains of the central part of the state (Sanpete County)."

4. Lake States and High Plains Regions.

The wolverine is believed to have been extirpated from the Lake States area by the early 1900s, from the High Plains also, apparently at some unknown date (Banci 1994).

a. Michigan

The wolverine appears to have been extirpated from Michigan prior to 1900, although the animal may have roamed the entire state earlier. The wolverine remains a sort of mascot/totem animal for Michigan residents to this day.

b. Minnesota

An official of the Minnesota Department of Natural Resources noted that there were no wolverines in Minnesota and probably there never had been many ("No authentic observation for

30-40 years," "extremely rare in old trapping records") (pers. comm., n.d.). Wolverines continue to be reported from time to time in the northeastern part of the state. It appears that a wolverine augmentation/reintroduction program was not carried out owing to lack of state cooperation.

c. Wisconsin

In response to an inquiry, an official of the Wisconsin Department of Natural Resources stated that the wolverine was "extirpated" in that state, "None present so no threats" (Letter, Wisconsin Department of Natural Resources, Bureau of Endangered Resources, November 7, 1998). Wolverines are known to have occurred historically in Wisconsin (e.g., Jackson, 1961).

d. North Dakota and South Dakota

Historical records of wolverines exist, but no sightings have been recently confirmed in either state.

5. Northeastern U.S. Region

Banci (1994) reports that wolverine range once extended across North America from the 38th parallel northward, but it appears to be unknown when the species disappeared from the northeastern U.S.

B. Protected Status of the Wolverine

1. Federal protections

The Biodiversity Legal Foundation and Predator Conservation Alliance (formerly "Predator Project") first petitioned on behalf of the wolverine for protection under the Endangered Species Act on August 3, 1994. The U.S. Fish and Wildlife Service failed to rule on the petition, so the BLF, the PCA, and the Voice of the Environment filed suit on April 13, 1995 to force a 90-day finding on the petition. The U.S. Fish and Wildlife Service responded with a "not warranted" finding in which it claimed that petitioners had failed to adequately demonstrate historical and current wolverine distribution and abundance, failed to adequately document threats, and failed to link threats to wolverine declines (USDI 1995; 60 Fed. Reg. at 19567).

Biodiversity Legal Foundation and Predator Conservation Alliance filed a second petition to gain ESA protections for the wolverine on July 11, 2000. The groups were joined by Defenders of Wildlife, Friends of the Clearwater, Northwest Ecosystem Alliance, and Superior Wilderness Action Network. The U.S. Fish and Wildlife Service responded with a letter and press release stating "... The agency will not be able to begin work on the petition until funds and staff

become available" (FWS press release, 8/29/00). As a consequence of its failure to rule within 90 days whether the petition may be warranted, the petitioners filed a Notice of Intent to Sue the Fish and Wildlife Service on December 20, 2000.

Despite attempts to have the wolverine listed for protection under the ESA, the species is presently without federal standing of any kind other than Forest Service and Bureau of Land Management designations. The wolverine is listed as "Sensitive" in U.S. Forest Service Regions 1, 2, 4, and 6; and "Proposed Sensitive" in Region 5 (Butts 1992). Likewise, the U.S. Bureau of Land Management (BLM) has classified the wolverine as "Sensitive" (Butts 1992). The wolverine was classified as a Category 2 candidate species for listing by the U.S. Fish and Wildlife Service, but this classification was eliminated in 1996. The wolverine is not on the current "candidate species" list, recently published by the U.S. Fish and Wildlife Service (63 Fed. Reg. at 57534).

2. State protections

Wolverine trapping is prohibited in all states except for Montana. A bag limit of one wolverine per trapper was implemented in Montana in 1975 and approximately 12 wolverines are taken every year. Given the low population numbers of wolverines in increasingly isolated mountain ranges across western Montana, there is considerable doubt that even the low numbers of wolverines that are still legally trapped every year in Montana are sustainable.

The trapping season for wolverine closed in Idaho in 1965, and this may have slowed the current decline of wolverine in Idaho as compared to Montana. The State of Idaho lists the wolverine as a Species of Special Concern.

Wyoming Game and Fish Department considers the wolverine a Species of Special Concern, Category 3, meaning the state considers its extirpation from Wyoming possible but not imminent.

In Washington, the wolverine is designated 'protected wildlife' (SAC 23223-011) in the Wildlife Code of Washington and has recently been added to the pool of species that are candidates for state listing (Letter, Richardson to Jensen, November 13, 1998).

In Oregon and in California, the wolverine is listed as Threatened under those states' Endangered Species Acts.

In Colorado, the wolverine is listed as Endangered under the state Endangered Species Act.

3. Canada protections

The Committee on the Status of Endangered wildlife in Canada (1998) lists the eastern and Labrador wolverine populations as "Endangered." The western populations are listed as "Vulnerable." Despite this protected status, approximately 800 wolverines are trapped in Canada every year (Copeland 1996).

Part II. Ecological factors limiting the survival and recovery of wolverines in North America

To set the context for a discussion of wolverine conservation needs, it is important to understand some ecological factors that have a tremendous affect on wolverine survival and recovery. For example, the following information demonstrates why the wolverine is not well-served by the traditional conservation approach of setting aside small, isolated protected areas. Instead, a regional approach is needed that provides for the protection of wolverine population centers as well as dispersal routes between them throughout the western and northern U.S. and Canada.

A. Large range requirements

Wolverines exist at even lower densities than other mid-sized carnivores: "Not a hunter, [the wolverine] depends on wolves and other predators to provide carrion" (Banci, 1994; p. 100). Wolverine diet can also be provided by avalanches, starvation, and other factors. How much space does a wolverine need to meet its needs? Banci (1994) wrote: "Home ranges of adult wolverine in North America range from less than 100 km² to over 900 km². . . The variation in home range sizes among studies partly may be related to differences in the abundance and distribution of food... In northwest Alaska, food levels were particularly low and dispersed because of the absence of overwintering caribou and home ranges of wolverine were larger than all others reported (Magoun, 1985)" (p. 117). Thus, comparatively small home ranges may reflect more abundant food sources, larger ones scarcer food.

Examples of wolverine range sizes in the western U.S. and southwestern Canada observed during field studies include the following:

(Hornocker and Hash 1981)

The average yearly range of male and female wolverines was 422 and 388 km², respectively. Two lactating females exhibited very similar, greatly reduced spring and summer ranges of 100 km² each." (1291)

(Copeland 1996)

Avg. annual home ranges: 384 km² for females (SD = 117), 1,582 km² for males (SD = 488)... "Prior to my study, the upper limit of reported wolverine home range size was under 1,000 km²." (pp.49-68)

(Krebs and Lewis 1999)

“Home ranges (Table 3) of males (1005 km²) were significantly greater than females (311 km²; $t_{1,18} = 2.85$, $p < 0.01$). Subadult males had larger average home ranges than adult males (1611 km² vs. 601 km²; $t_{1,8} = 2.18$, $p = 0.058$), whereas subadult female home ranges did not differ significantly from adult females (274 km² vs. 335 km²; $t_{1,8} = 0.66$, $p = 0.27$). Male home ranges appear to overlap those of 1 or more females and those of other males, while ranges of females are exclusive except for accompanying young of the year and in some cases non-breeding sub-adults. Home range boundaries were defined by geographic (eg. watercourses) and manmade features (eg. reservoir, highway).” (12)

B. Dispersal and movements

The wolverine's ability to move impressive distances across rugged and inhospitable terrain provides hope that seemingly disparate populations may be connected, but also presents the challenge of protecting wolverines across vast unprotected areas. Wolverine movements observed in field studies include the following excerpts.

(Hornocker and Hash 1981)

“Males throughout the study area traveled noticeably greater distances than females. The maximum distance traveled in 3 days was 64 km for males and 38 km for females.” (1290)

(Copeland 1996)

"Four male wolverines dispersed at sexual maturity, with 2 emigrating distances greater than 185 km." (p.iv)...
"Wolverines are capable of traveling over 30 km/day." (p.12)

"Hornocker and Hash (1981) recommended a regional management approach based on movements of their study wolverines outside their study area, although they did not provide movement distances. Magoun (1985) reported a 300 km movement of an unknown age female. Idaho wolverines also traveled extended distances (Table 3.3) with 3 individuals traveling over 200 km in apparent dispersal attempts." (p. 87)

"Dispersal carries a high risk of starvation or predation and data on the fate of dispersing individuals are scarce." (p. 91)

C. Low population densities

Even in the best conditions, wolverines survive at very low densities, meaning that wolverine habitat must remain contiguous across very large areas to support a viable wolverine population. Examples of estimated wolverine population densities include the following.

(Hornocker and Hash 1981)

"A minimum population size of 20 was estimated for the 1300-km² area, or one wolverine per 65 km². The population was believed stable..." (1286)

“Wolverines occur at low densities and even in optimal habitat are less abundant than other carnivores (van Zyll de Jong 1975; Krott 1959; Quick 1953). Quick (1953) estimated a density of one wolverine per 207 km² in British Columbia, basing his estimate on returns from a registered trapline. Our density for a 1300-km² area, based on our

estimate of 20 wolverines, was one per 65 km², or one per 25 mi². This greater density may be a result of a more plentiful food supply." (1295-1296)

(Copeland 1996)

"Dividing the home range area of the resident adult females by the potential number of residents provides a density estimate of 1 wolverine/90-113 km². A more conservative estimate may be based on the 1,980 km² total home range area of the resident male. This produces a density range of 1 wolverine/198-248 km²." (p.32)

(Krebs and Lewis 1999)

"Density estimates reported from published studies utilizing radio-telemetry and mean home range size tend to yield higher and more variable density estimates (1/65 km², Hornocker and Hash (1981); 1/48 km², Magoun (1985); 1/177 km², Banci 1987; 1/198 km², Copeland 1996) than those based on snow-tracking (1/207 km², Quick 1953; 1/193 km², Becker 1991). Whether these differences are related to the estimation techniques or actual differences in wolverine density is not certain. Our estimate (1/167 km²) using four years of live-trapping information falls within the range of those reported above." (18)

D. Low reproductive rates

Banci (1994) relates evidence that wolverines are not prolific reproducers: "Reproductive rates are low and sexual maturity delayed, even in comparison with other mammalian carnivores" (p. 108). Years when food is scarce may inhibit litter production if females are in poor nutritional condition. Some observers have speculated that lack of suitable denning habitat may also inhibit reproduction. Banci further reports:

"Wolverines exhibit delayed implantation, during which development of the embryo is arrested at the blastocyst stage. Implantation in the uterine wall can occur as early as November (Banci and Harestad 1988) or as late as March (Rausch and Pearson 1972)" (p. 104).

Kits are weaned at 9-10 weeks, and grow at a faster rate than many other mammals, reaching adult size by seven months of age (Banci, 1994, citing Magoun, 1985). Banci relates the correlation between reproductive rate and fitness:

"Iversen (1972) suggested that the rapid increase in total heat production during the early phase of growth resulted from a faster growth of the high energy-producing tissues compared to other mammals... This, in turn places high energetic demands on mothers and can affect female reproduction in the immediate future" (Banci, 1994).

Regarding their age of first reproduction, female wolverines do not breed during their first summer, while males remain sexually immature until after their first two years (Banci, 1994).

The results from field research in the lower-48 states and southern Canada indicate very low reproductive rates, to the extent they have been determined.

(Hornocker and Hash 1981)

“We know... from our capture-recapture data, that not all females produce young every year or every 2 years... In fact, only two of the eight females mature at the time of first capture appeared pregnant. Therefore, we believe no more than half the females present on our area were reproductively active in each of the 5 years of our study.” (1297)

(Copeland 1996)

"Three females... produced no documented litters during 3 reproductive seasons, while 3 females... produced 5 documented litters in 7 reproductive seasons for an overall reproductive rate of 0.50 litters/female/year. Number of individual kits/female was calculated from 4 females that produced 8 kits in 9 reproductive seasons for a rate of 0.89 kits/female/year. Evidence of pregnancy was measured for 6 females and confirmed 6 times in 13 reproductive seasons for an annual pregnancy rate of 0.46." (p. 35)

(Krebs and Lewis 1999)

The low survivorship of wolverines in their study area combined with the low reproductive rate gives these researchers special cause for concern:

“Three litters of 2 kits each have been produced over 14 adult female reproductive seasons... Limited data suggest reproductive rates varied greatly between years... Females used dens during 5 seasons but either did not produce young that survived to weaning age or young were not detected. During the remaining 6 seasons females did not establish dens.” (9)

“... Magoun (1985), suggested that annual survivorship need be 0.906 or greater for a hypothetical wolverine population in NW Alaska to be stationary or stable. Our estimate of 0.77, falls well below this threshold which may indicate a decline. Closer examination of the assumptions used in the Alaskan analysis will be required to determine if this is the case.” (16)

"In Idaho, Copeland (1996) documented a reproductive rate of 0.67 kits/female/year; Magoun (1985) in NW Alaska reported 0.69 kits/female/year. Our present estimate of 0.43 kits/female/year is lower but is based on a low sample size. Differences arise through strong year effects, presumably related to food availability. In 1997 we had 2 litters from 5 adult females whereas in 1998 only 1 litter was produced from 6 females. These rates are well below the averages reported using corpora lutea, placental scars and fetus counts from carcasses (Rausch and Pearson 1972; Liskop et al. 1981; Banci and Harestad 1988).” (16)

Part III. Science-based policies needed to protect and restore the wolverine and its habitat throughout the U.S. lower-48 states

A. Forest practices, access, and recreation

While wolverines do not depend upon a specialized habitat type (such as "old growth" forest), they do require: (1) large areas of contiguous habitat largely free of human disturbance, and (2) protection of denning habitat in particular. They also require ample prey base, meaning quality and productive habitat for ungulates, rodents, and other prey for the wolverine to scavenge and hunt year-round.

1. Maintain forested areas largely free of human disturbance

a. Identify priority habitat for wolverines

Banci (1994) describes the basic parameters of wolverine habitat in North America:

"Broadly, wolverines are restricted to boreal forests, tundra, and western mountains [in North America]. The vegetation zones (Crowley 1967; Rowe 1972; Hunt 1974; Bailey 1980; Allen 1987) occupied by wolverines include the Arctic Tundra, Subarctic Alpine Tundra, Boreal Forests, Northeast Mixed Forest, Redwood Forest, and Coniferous Forest. They are absent from all other vegetation zones, including the prairie, deciduous, and mixed forests of eastern North America; California grassland-chapparral; and sagebrush and creosote scrublands."

Field studies in Montana, Idaho, and southern Canada provide some additional guidance.

(Hornocker and Hash 1981)

"We believe that food availability is the primary factor determining movements and range in our area. Breeding activity influenced seasonal movements of males but not females. Food is apparently more available, either as carrion or prey, in the mature or intermediate timber stands preferred as wolverine habitat, especially edge or ecotonal areas around cliffs, slides, blowdowns, basins, swamps, and meadows. These habitats also were preferred by fishers (*Martes pennanti*) radio tracked concurrently with this study, and by a marten (*Martes martes*) [*Martes americana*?] population in the Selway-Bitterroot Wilderness Area in Idaho (Koehler and Hornocker 1977). Cover provided by mature or intermediate timber is also important in habitat selection.

"Large areas of medium or scattered mature timber accounted for 70% of all relocations. The remaining location sites were in ecotonal areas, small timber pockets, rocky, broken areas of timbered benches. Areas of dense, young timber were used least." (1291)

"Wolverines selected *Abies* [Fir] types on a year-round basis... There was a definite strong selection for these alpine fir types in summer; these types occur at the higher cooler elevations sought by wolverines in hot weather." (1291-1292)

(Copeland 1996)

"Distinct seasonal shifts in elevational use were recorded, with higher elevational talus/rock cover types preferred during summer months, and montane coniferous forest cover types preferred during winter." (p.iv).

"Rendezvous sites... Five of the sites [identified] were talus and 5 were coniferous riparian... Riparian sites occurred within lower slope spruce/fir riparian areas... All were characterized by a mesic, dense shrub and regenerating conifer understory associated with multiple layered timber downfall." (p.98)

"Montane coniferous forest types constituted 66.0% of available habitat and accounted for 70.2% of wolverine relocations. There was an inverse relationship between seasonal use of Douglas-fir and lodgepole pine, with Douglas-fir preferred in summer and lodgepole pine favored in winter... Wolverines were located in openings, defined as any break in the canopy resulting in an observable change in the understory composition, on 34% of relocations and were located in burned areas 34 times. Three wolverines were located in logging areas, 1 in a clearcut and 2 near active sales." (p.120)

(Krebs and Lewis 1999)

“Use of available habitat differed between males and females ($G = 68.7$, $df = 2$, $p < .005$) and by season. In winter, males used [Interior Cedar Hemlock] habitats proportionately greater than expected (Figure 3; $G = 126.6$, $df = 2$, $p < 0.001$) whereas females used [Englemann Spruce-Subalpine Fir] habitats more (Figure 3; $G = 61.0$, $df = 2$, $p < 0.001$). In summer, males spent more time in [Englemann Spruce-Subalpine Fir] habitats while females used higher elevation [Alpine Tundra] habitats (Figure 3). The effects of human activities and land use have not been analysed.” (13)

b. Protect suitable habitat from human disturbance

Besides forested cover and an adequate prey base, the level of human activity is clearly a primary factor for wolverine habitat (Banci, 1994):

"Within its geographic range, the wolverine occupies a variety of habitats. However, a general trait of areas occupied by wolverines is their remoteness from humans and human developments."

"Refugia, large areas that are not trapped and free from land-use impacts, can serve as sources of dispersing individuals and have been shown to be effective at ensuring the persistence and recovery of fisher and American marten populations (deVos 1951, Coulter 1960). The persistence of wolverine populations in Montana, despite years of unlimited trapping and hunting, was attributed solely to the presence of designated wilderness and remote, inaccessible habitat (Hornocker and Hash 1981). "Wolverines persisted in southwestern Alberta despite their extirpation elsewhere in the province, largely because of the presence of large refugia in the form of national parks." (p. 108)

Further evidence for the need for refugia from human disturbance in the scientific literature includes the following.

(Hornocker and Hash 1981)

“Wolverine populations in northwestern Montana survived the years of unlimited hunting and trapping solely because of the vast expanses of official wilderness and remote, essentially wilderness habitat. These areas functioned as both refuge and reservoir for wolverine populations.” (1300)

(Copeland 1996)

"Refugia may be most important in providing availability and protection of reproductive denning habitat. Life history requirements of the wolverine are tied to the presence and stability of ecosystems lacking broad scale human influence... Habitat alteration may isolate subpopulations increasing their susceptibility to extinction processes." (p.130)

(Krebs and Lewis 1999)

“Between January 1995 and October 1998, 1256 radio telemetry locations were obtained from 43 individual animals radio collared/implanted... Four clear "peaks" in use (25% probability contour) are evident; the largest located in Glacier National Park, followed by Mt Revelstoke National Park, Bigmouth/Windy Creek (north) and Downie/Goldstream (centre). Overlay techniques clearly demonstrate that high use areas ("peaks") are found in protected areas in greater proportion than expected based on relative trapping effort and park areal extent. Protected

areas comprise approximately 20% of the study area; include approximately 11% of the high trapping effort area (25% contour), but contain over 68% of the high use area (Figure 2 & 4).” (14-15)

“The uneven distribution of wolverine use across the study area (Figure 4) suggests that habitat quality is not equal across the area. The two largest "peaks" in use are centred on Glacier and Mt. Revelstoke National Parks. The Upper Bigmouth/Windy Creek "peak" area appears to support a high proportion of the wolverine population in the northern portion of the study area and may function as a refugia (Hatler 1989), similar to the national park areas... At present most of this area is a *defacto* wilderness with access only in Bigmouth Creek.” (19)

"National Parks and unroaded wilderness areas appear to act as refugia at present. Pressures from commercial backcountry use, snowmobiling and logging may erode the capacity of these areas to support wolverine, particularly reproductive females." (19-20)

(IDFG 1995)

- Refugia provides core habitat for wolverine populations. Increased human presence, reduction, or alteration of existing refugia may threaten wolverine persistence

Further evidence for specific protections to maintain and restore habitat security for wolverines is found in the scientific literature from the Rocky Mountains of the U.S. and Canada.

i. Maintain unroaded areas and restore roaded areas by maintaining road densities at no greater than one mile of road per square mile of habitat.

While there is little scientific evidence to support a specific road density standard for wolverines, it is clear that unroaded areas serve as very important refugia for wolverines (especially denning females—see below), and that wolverines will no longer use an area once human disturbance exceeds a certain threshold. To address this problem, the Forest Service has proposed a road density standard of one mile per square mile within priority wolverine habitat (USDA 1994).

(Krebs and Lewis 1999)

“All dens have been found within roadless, tributary valleys in the ESSFvc biogeoclimatic subzone under woody debris or a combination of woody debris and large boulders... Four of the seven den sites were located in National Parks.” (11)

ii. Limit clearcut logging within priority wolverine habitat.

(Hornocker and Hash 1981)

“No wolverines were located in clear cuts of any size; however, tracks were observed crossing clear-cut areas 15 times. Wolverines were located within 1 to 3 km of clear cuts and active roads 12 times. Male wolverines were found farther from active roads, clear cuts, and burns than females.” (1292)

"Wolverines appear reluctant to cross openings of any size such as recent clear cuts or burns. Tracking revealed that wolverines meandered through timber types, hunting and investigating, but made straight-line movements across large openings. Tracks further indicated they often ran or loped across such openings." (1298-1299)

“Clear cuts have altered the nonwilderness portion substantially (see Ramirez and Hornocker 1981). These areas functioned in a similar manner to burns in the wilderness, relative to small mammal habitat. Such habitat changes can enhance herbivore and small mammal populations and thus increase the food supply for predatory species. In such habitat manipulations, however, with wolverine ecology in mind, consideration should be given to size, shape, and aspect of individual clear cuts. Wolverines in this study preferred basins, southerly and easterly slopes, and edge and ecotonal areas. These areas ideally should be left intact.” (1300)

iii. Roads used to access logging operations and other developments should be closed and obliterated, including snowmobile use in winter.

(Hornocker and Hash 1981):

"Further use of roads built in logging operations should be strictly regulated, particularly in winter. If higher inaccessible country is adjacent to clear-cut areas, wolverines will separate themselves naturally from human activity in summer. In winter and early spring, however, human access on snowmobiles or all-terrain vehicles could bring about disturbance and conflict, not to mention ease of access for fur trappers." (1300)

iv. Mining activity, developed campgrounds, and other permanent developments should be prohibited from priority wolverine habitat, because the associated human activity is likely to displace wolverines from the area.

(IDFG 1995)

- Mining activity, road building, or developed campgrounds near subalpine boulder talus sites may eliminate historical or potential wolverine foraging or denning habitat.
- Avoid the establishment of developed mines in core habitat.
- Avoid permanent campgrounds and establishment of road and trail systems into subalpine rock/scree sites within core habitat.

2. Protect wolverine denning habitat from human disturbance

Copeland (1996) emphasizes the importance of denning habitat for the wolverine:

"Central Idaho wolverines appeared highly selective in choice of natal denning and kit rearing habitat... Even with adequate food, wolverines may not be resident without suitable denning habitat." (p.72)

Further, female wolverines with newborn kits are extremely sensitive to human disturbance, and denning occurs during the late winter months when energetic demands are highest. For example, researcher Jeff Copeland relates an anecdote of a mother wolverine who discovered researchers' snowshoe tracks near her den, followed them to within 20 m of the researchers, immediately returned to her den and took off in the opposite direction with a kit in her mouth, and returned 30 minutes later to repeat this with her second kit. (pp.96-7, Copeland 1996). Similarly, researcher John Krebs related an anecdote whereby a helicopter skiing operation within his study area in

British Columbia displaced a female wolverine 10-15 km from her newborn kits (J. Krebs, pers comm., Western Forest Carnivore Committee meeting, May 2000). Copeland (1996) concludes:

"Protection of natal denning habitat from human disturbance is critical for the persistence of the wolverine in Idaho. The clear association between wolverine presence and refugia may be strongly linked to a lack of available natal denning habitat outside protected areas... Technological advances in over-snow vehicles and increased interest in winter recreation has likely displaced wolverines from potential denning habitat and will continue to threaten what may be a limited resource." (p.129)

a. Identify suitable denning habitat

Banci (1994) summarizes the early literature regarding denning habitat for wolverines:

"Information on the use of natal dens in which the kits are born by wolverines in North America is biased to tundra regions where dens are easily located and observed. These natal dens typically consist of snow tunnels up to 60 m in length. Northern European dens have been noted in boulder fields and talus slopes... Natal dens may be located near abundant food, such as cached carcasses or live prey (Haglund 1966, Rausch and Pearson 1972, Youngman 1975)."

Wolverine dens, in the northern hemisphere have included hollow trees, holes under tree roots, overturned trees (Banci 1994):

"Rarely, kits have been found relatively unprotected, on branches and on the bare ground... abandoned beaver lodges... old bear dens... creek beds, under fallen logs, under the roots of upturned trees, or among boulders and rock ledges."

(Copeland 1996)

"Females used secluded high elevation cirque basins for natal den sites." (p.iv)

"The denning habitat used by 2 marked females and 1 unmarked female in Idaho was specific to subalpine talus habitats. The availability of talus communities throughout Idaho may define limitations for wolverine reproductive potential." (p.93)

"Natal sites were located in isolated talus slopes that were less than 100 m wide and surrounded by trees, as opposed to the more expansive and exposed talus slopes generally characterizing glacial cirques." (p.94)

(Krebs and Lewis 1999)

"Reproductive females established dens in areas with little or no human disturbance, below treeline under avalanche debris or large boulders. Although at the stand or patch scale, all dens located to date have been found in non-forested habitats similar to those reported by Magoun and Copeland (1998), our data differ when viewed at the landscape scale. Results clearly suggest that the upper elevation forested zone [Englemann Spruce-Subalpine Fir], not the alpine/parkland zone are most used for denning. Additional factors such as human activity, distribution of prey/carrion and presence of other predators likely affect the suitability of an area as denning habitat but have not yet been investigated." (17)

b. Protect suitable denning habitat from snowmobiles, helicopter skiing, and other forms of intensive human use, especially during denning season (February through May)

(Copeland 1996)

"Females in arctic Alaska remained at a single den until late April or early May and did not appear disturbed by the presence of human observers (Magoun 1985)... Finnoscandian studies [studies from Finland or other Scandinavian countries?] report den abandonment as a common response to human disturbance... Myrberet (1968) mentions 4 instances of den abandonment due to human disturbance and suggests that secondary dens may be less suitable. My data is consistent with this. My first direct contact with denning females did not occur until late April and resulted in immediate den abandonment." (p.93)

"When viewed in conjunction with potential displacement and disturbance of denning females by winter recreational activities of humans, denning habitat may be a limited and critical component of wolverine habitat." (p.93)

"Subalpine cirque areas important for natal denning may be made unavailable by winter recreational activities. Conversely, high road densities, timber sales, or housing developments on the fringes of subalpine habitats may reduce potential for winter foraging and kit rearing and increase the probability of human-caused wolverine mortality." (p.130)

(Krebs and Lewis 1999)

"Four suspected and 3 confirmed natal den sites have been found between 1995 and 1998 (Table 2). All dens have been found within roadless, tributary valleys in the ESSFvc biogeoclimatic subzone under woody debris or a combination of woody debris and large boulders. Females occupied dens as early as late February and used them until mid May in some cases. Den sites were not re-used in subsequent years. Four of the seven den sites were located in National Parks." (11)

(IDFG 1995)

- Post-partum females appear to be extremely sensitive to disturbance during the pre-weaning kit rearing period. Recreational activities may displace them from potential denning habitat or cause den abandonment.

3. Maintain and restore quality habitat for ungulates and other prey within wolverine habitat

(Copeland 1996)

Ungulates, both wild and domestic, were the most common [wolverine] food item, representing 45.8% of all occurrences... ungulates comprised 44.4% of summer and 46.3% of winter occurrences. ...Small mammals (all rodents and lagomorphs) were the second most common item occurring at 20.7%. Carnivore species comprised 20.1% of occurrences with marten, skunk (*Mephitis mephitis*) and black bear present in small numbers in both summer and winter collections. Vegetative items comprised 25.6% of occurrences with conifer needles making up 80.8% of the vegetative sample. Insects, primarily ants, occurred at 5.9%, while soil and gravel, and man-made plastics and fibers were present at 6.4% and 1.9% respectively. (pp. 101-102)

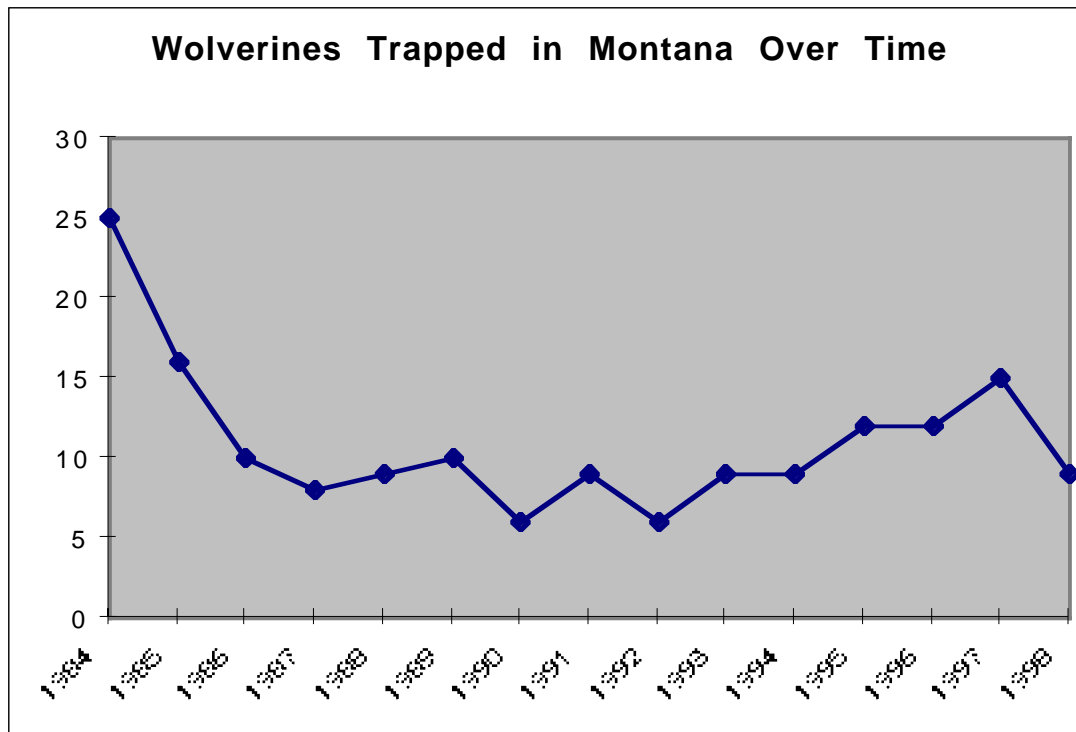
"A close relationship exists between wolverine and ungulate presence. Ungulate carrion is a primary food item, and activities that decrease large mammal populations may negatively affect carrion availability. Excessive hunter

harvesting and loss of ungulate wintering areas as well as displacement of ungulate populations due to excessive timber harvest and urbanization may adversely impact wolverines. Ungulate wounding from hunting and livestock losses on public grazing allotments most likely provides a consistent carrion source. Management practices that reduce the presence and opportunity for carrion availability may impact wolverine foraging success." (p.130)

(Krebs and Lewis 1999)

"Maintenance of an abundant, diverse ungulate community is a necessary precursor to persistence of wolverine. Habitat and harvest management strategies which maintain moose, mountain goat and caribou populations will benefit wolverine." (19-20)

B. Trapping



Montana is the only state in the "lower 48" that still allows wolverine trapping. The season extends from December 1 through February 15 and there is no statewide quota, although there is a "bag limit" of one wolverine per trapper.

1. Trapping has been the primary source of wolverine mortality in North America.

(Hornocker and Hash 1981)

Fifteen of eighteen recorded mortalities were due to commercial trappers during the five winters of this study:

"Eighteen mortalities were recorded during the study... Three marked wolverines... died of "natural" causes. Fifteen wolverines, nine males, five females, and one of unknown sex, were known to be removed by commercial trappers during the five winters... In addition, six individuals, four males and two females, were caught by trappers in the South Fork drainage the winter before our study began." (1290)

“Van Zyll de Jong (1975)... states ‘of the biotic factors in the wolverine’s environment, predation by humans appears to be the most likely factor to have affected the number of wolverines.’ Clearly this was the situation in our study. Of 18 known mortalities in the five winters from 1972-1973 to 1976-1977, 15 were human caused. In addition, six were known to be removed by trappers the year before our study began. Wolverines are highly susceptible to trapping because they travel widely and are readily attracted to baits. Any of the adult wolverines in our work were missing one or more toes and many had broken teeth. We believe many of these mutilations were the result of encounters with leg-hold traps.” (1297)

(Copeland 1996)

"Canada harvests about 800 wolverines each year yet still considers it one of its rarest mammals." (p.2)

2. Trapping for wolverines should be prohibited from all areas where the practice is not known to be sustainable and compatible with maintaining healthy and robust wolverine populations.

(Krebs and Lewis 1999)

"Human caused mortality of wolverine from trapping and transportation corridors is the largest factor influencing survivorship. Trapping restrictions may be warranted if rates are found to be unsustainable. Tracking harvest sex and age through compulsory inspection would assist management decisions." (19-20)

“A total of 11 radio-collared animals have died during the study, 4 were commercially trapped (M207, M217, M246, F206), 1 was killed on the Trans-Canada Highway in GNP (M212), 1 was killed on the CP Rail line in GNP (F223), 2 died of natural causes (F204, F229) and 2 were killed by other predators (M230, M208). One male (M224) died as a result of injuries received from either a fall or being kicked by a moose. At least three additional wolverine which had lost their radio-collars have also been commercially trapped (M201, F219, M232) and 1 other ear-tagged animal was recovered by backcountry skiers in Mt. Revelstoke Park (M209). Using only the radio-telemetry located mortalities, annual survivorship for all collared wolverine up until January 1999 was 0.77 (95% CI: 0.66 - 0.88). Estimate for females only was similar (0.74, 95% CI: 0.55 - 0.93); kit survival was slightly lower (0.61, 95% CI: 0.21 - 1.0) but is based on a limited sample size” (9).

3. Incidental take — wolverines killed in traps set for other species — is a significant threat to the wolverine, and thus all trapping that may pose a risk to wolverines should be prohibited within priority wolverine habitat.

(Hornocker and Hash 1981)

"The annual take has declined markedly despite the fact that some wolverines are trapped incidentally to the taking of other furbearers." (1299)

“Because of their scavenging nature, wolverines come readily to bait and are vulnerable to skilled trappers. In areas where enhancement of wolverine populations is the goal, bait trapping for all species should be curtailed. Further, seasons should be adjusted for closure in late winter and early spring when young are born. Females with newborn young are limited in their ranging and foraging and are especially vulnerable to easily obtained trap baits.” (1300)

(Hash 1987)

“Hunting and trapping appear to be the primary sources of mortality for adult wolverines, as the species has few natural enemies. Wolverine are vulnerable to bait trapping because their scavenging nature and long distance travel patterns increase the overall probability of their encountering traps, even in remote areas. In contrast, females with newborn young are limited in their ranging and foraging and as a result become especially vulnerable to easily obtained trap baits (Hornocker and Hash 1981). Bait trapping for all species should be prohibited in areas where expansion of wolverine populations is desired. Harvest seasons should be closed during late winter and early spring (Feb-Apr) to protect females with kits. Wolverine are susceptible to traps intended for other species; any set made for a coyote, lynx, bobcat, or wolf can effectively take a wolverine.” (583)

(IDFG 1995)

- Trapping of wolverines or incidental catches may threaten local populations.
- Predator control programs that use poison baiting techniques put wolverines at risk. Further, management practices which reduce availability of carrion availability will result in negative impacts.

C. Connectivity vs. Fragmentation

1. Because of their wide ranges and low population densities, wolverine conservation and management requires a regional perspective. Priority habitats for sub-populations should be identified and protected, as well as areas of connection between these sub-populations, across the entire western United States and Canada.

(Hornocker and Hash 1981)

"Regional, rather than local, populations must be considered in any management program. Our study area was large, relative to that for other species, yet it became clear we were dealing with a local unit of a regional population. Individuals routinely traveled far beyond the boundaries we set arbitrarily, but because of logistics, necessarily set. By traveling widely in a short period of time, individual wolverines give a false impression of abundance. Tracks encountered in widely separated major drainages, often divided by high mountains ranges, may in fact be made by the same individual. This should be taken into account when unit or area harvest regulations are set." (1300)

(Krebs and Lewis 1999)

"... Since wolverine operate at the landscape scale, with home ranges averaging 300km² for females and 1000km² for males in our study area, habitat selection is unlikely to be strongly tied to stand or patch level attributes. Rather, habitat patch size, juxtaposition and prey density/distribution may be more important factors." (18)

(Edelmann and Copeland 1999)

"Low dispersal may impact the regional viability of wolverine by lowering the likelihood that suitable habitat patches are inhabited over time. Maintaining and enhancing the integrity of movement corridors between the Seven Devils Mountains and other contiguous mountain habitats in Idaho and Oregon may be essential for ensuring wolverine persistence." (abstract)

"Simple visual inspection of wolverine sightings plotted at the regional scale suggested three somewhat distinct clusters within our hypothesized distribution of wolverine... These clusters corresponded to the 1) northern Cascade Mountains in Washington, 2) southern Cascade Mountains in Oregon, and 3) northern Rocky Mountains in Idaho. The clusters may represent three subpopulations within a larger, spatially-structured population in the northwestern United States. ...[T]he Seven Devils Mountains may provide the only suitable habitat linking the reproducing

population in central Idaho (Copeland 1996) with northeast Oregon, and also potentially with the southern Cascade Mountains." (p. 297)

(IDFG 1995)

- Wolverine populations may be threatened by habitat fragmentation which could lead to population isolation and eventual extinction.
- Habitat connectivity with Montana, Canadian and northern Washington most likely provides subpopulation interspersions throughout the northern range.
- Habitat alteration and human occupation within refugia may decrease subpopulation extent and interspersions as well as create barriers to emigration.
- Managers need to identify critical dispersal corridors to link subpopulations
- Regulations for local populations must be based on regional data

2. Highways threaten wolverines due to direct mortality and especially because they may pose a barrier to movement, thereby isolating wolverine populations and areas of suitable habitat across the Rocky Mountains of the U.S. and Canada.

(Krebs and Lewis 1999)

"Home range boundaries were defined by geographic (eg. watercourses) and manmade features (eg. reservoir, highway). Three animals crossed the Trans-Canada highway at least 4 times; one was struck and killed." (12)

"Carrion along the road and rail right-of-ways needs to be disposed of rapidly to avoid collateral kill of carnivores such as wolverine." (19-20)

(Ruediger et al. 1999)

Bill Ruediger, Threatened, Endangered and Sensitive Species Program Leader for the Northern Region of the U.S. Forest Service, describes the current threat to the wolverine and other forest carnivores due to landscape fragmentation:

"The best opportunity for management of a functional carnivore community in North America is the Northern Rocky Mountains of the United States and the Southern Rocky Mountains of Canada. It may be the last place in the lower 48 states where this opportunity exists. The area extends from the Wyoming Range in Wyoming north to Jasper National Park in Canada (Paquet, 1995). One of the major issues in conservation of carnivores in this area is the expanding highway and railroad system. Another is strip development as humans expand out from towns and cities...

"As the highway system (and railroad) grows in size, traffic volume and total miles, its impacts on wildlife will grow. The impacts on low density carnivores like grizzly bears, wolves, lynx, wolverine and fisher will be more severe than most other wildlife species. This is due to their large home ranges, relatively low fecundity, and low natural population density. The adverse effects of highways to rare carnivores and other wildlife include serious habitat fragmentation, mortality, direct loss of habitat, displacement from noise and human activity and secondary loss of habitat due to human sprawl...

"When traffic volume increases, there is an evolution of highways from gravel roads to paved two lane roads, and from two lane highways to more problematic four lane highways and "super highways" like the Interstate system.

The eventual result of such a progression in the highway system on rare carnivores is the slow strangulation of viability due to population isolation, loss of habitat, mortality of individuals and a decline in potential population size. All of these factors are primary causative agents in the decline and extirpation of wildlife worldwide." (pp.1-2)

Ruediger et al. (1999) assesses the current landscape fragmentation problem in Montana and Idaho specifically:

"... The [land] ownership pattern is particularly problematic in western Montana, where mountain ranges are largely National Forest land, but the surrounding valley bottoms are mostly private lands. The private land is increasingly subject to subdivision, suburban sprawl and other uses incompatible to the long-term maintenance of wildlife habitat connectivity. Once the private lands are fully developed, western Montana will have only three large areas of carnivore refugia (Greater Yellowstone Area, Selway-Bitterroot Mountains and the Bob Marshall Wilderness-Glacier Park areas), with the remaining public land habitat in between these areas existing as "island" mountain ranges surrounded by developed private land.

"... In northern Idaho from Coeur d'Alene north, key linkage areas between the Selkirk Mountains, Cabinet Mountains and the Bitterroot Mountains are at risk and will require restoration. In western Idaho, linkage to the Wallowa and Blue Mountains in Oregon and Washington is at risk or absent. In eastern Idaho, Interstate 15 provides a formidable barrier between the Greater Yellowstone area and Bitterroot Mountains." (pp.5-6)

Other wolverine science "summary" documents:

- Petition for a Rule to List the Wolverine as Threatened or Endangered under the Endangered Species Act (Biodiversity Legal Foundation, Predator Conservation Alliance, et al. 2000);
- Wolverines: summary of available scientific research and management policies (Buecking 1998);
- "Wolverine" *in* Scientific Basis for Conserving Forest Carnivores (Banci 1994);
- Wolverine Biology and Management, a literature review and annotated bibliography (Butts 1992)
- "Wolverine" *in* Wild Furbearer Management and Conservation in North America (Hash 1987).

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