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WORKING PAPER NO. 18 JULY 2001

THE TRANSBOUNDARY FLATHEAD

A Critical Landscape for Carnivores in the Rocky Mountains

By John L. Weaver

WCS Working Papers Series

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2300 Southern Boulevard
Bronx, NY 10460

WCS Working Papers. ISSN 1530-4426

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SUGGESTED CITATION:
Weaver, John L. The Transboundry Flathead: A Critical Landscape for Carnivores in the Rocky Mountains. WCS Working Papers No. 18, July 2001.
Available for download from http://www.wcs.org/science

THE TRANSBOUNDARY FLATHEAD
BRITISH COLUMBIA AND MONTANA

CONTENTS

ACKNOWLEDGMENTS

This compilation and synthesis would not have been possible, of course, without the field data generated by many dedicated wildlife researchers (see Literature Cited). I wish to note specifically the outstanding long-term studies carried out by Bruce McLellan and Diane Boyd. Resource specialists at various organizations contributed important information and insights, including: Rob Neil, Bob Forbes, Bill Warkentin, and Per Wallenius of B.C. Ministry of Environment, Lands, and Parks; Bruce McLellan of the B.C. Ministry of Forests, Jim Clark and Richard Quinlan of Alberta Natural Resource Service; Tim Thier of Montana Fish, Wildlife, and Parks; Brace Hayden, Kate Kendall, Steve Gniadek, and Richard Meinke of Glacier National Park; Kathy Ake and Tom Wittinger of the Flathead National Forest; Clayton Apps of Aspen Wildlife Research; Dan Pletscher of the University of Montana; Paul Paquet of The University of Calgary; John Bergenske and Erica Konrad of the East Kootenay Environmental Society; Dave Hadden of the Montana Wilderness Association; Marilyn Wood of The Nature Conservancy of Montana; and Kathy Sheppard of the Land Conservancy of British Columbia. Bruce McLellan, Rob Neil, and Kyran Kunkel reviewed Part I of this assessment. I thank Tracy Lee and Bryne Butts of the Miistakis Institute in Calgary for their prompt and skillful preparation of the many GIS maps and Mark Fritch at the University of Montana's Instructional Media Services for his assistance. Funding for this report was provided by the Kendall Foundation, the Wilburforce Foundation, and the Wildlife Conservation Society; I salute Harvey Locke, Gary Tabor, and Bill Weber, respectively, for their passionate commitment to conservation.

SUMMARY

Carnivores are vital members of ecosystems but have been vanquished from many areas of North America by human activities. The Rocky Mountains from Yellowstone to the Yukon offer one of the last, best opportunities on the continent for conservation of carnivores. In the heart of the Rocky Mountains, the North Fork of the Flathead River headwaters in southeast British Columbia west of the Continental Divide and flows across the international border into Montana where it forms the western boundary of Glacier National Park.

In this report, I assess the importance of the transboundary Flathead area for carnivore conservation. For each of five carnivore species — wolf, lynx, marten, wolverine, and grizzly bear — I have compiled and synthesized available information about its: (1) ecological resilience, (2) key food resources and habitats, and (3) distribution, movements, and relative abundance. Additionally, I present similar information for three key prey species — moose, elk, and white-tailed deer.

All of these wildlife move across the international border making the Flathead River basin truly a transboundary landscape that must be managed as one integral, ecological unit. A unique community of carnivore species resides in the transboundary Flathead region that appears unmatched in North America for its variety, completeness, use of valley bottomlands, and density of species which are rare elsewhere. Due to these unique characteristics and its strategic position as a linkage between National Parks in both countries, the transboundary Flathead may be the single most important basin for carnivores in the Rocky Mountains. The entire transboundary Flathead basin appears important for carnivores, but the area from the west side of the Flathead River floodplain eastward to the Continental Divide in both British Columbia and Montana appears *especially* crucial. Watersheds adjacent to the transboundary Flathead also provide important habitat and security for carnivores.

The challenge is to develop and implement a transboundary conservation plan that honors these outstanding values. Key principles for carnivore conservation include to: (1) maintain food resources with management of habitat and prey populations, (2) provide security from excessive mortality with networks of core reserves and other precautionary measures, and (3) maintain regional connectivity with landscape linkages.

It is in this context of biological vulnerability, vanishing spaces, and beckoning opportunity that the transboundary Flathead assumes critical importance for carnivores as a crucible for our commitment to conservation.

THE TRANSBOUNDARY FLATHEAD
BRITISH COLUMBIA AND MONTANA

A CRITCAL LANDSCAPE FOR CARNIVORES IN THE ROCKY MOUNTAINS

INTRODUCTION

Carnivores are vital members of natural communities. A perspective is emerging from recent scientific studies that top carnivores can – at times – regulate prey populations and thereby influence the structure and function of ecosystems (Terborgh et al. 1999). For example, loss of top predators can lead to artificially high abundance of herbivores and smaller, generalist predators. The effects of this release, in turn, can ripple throughout the ecosystem – including the elimination of plant populations from over-browsing, loss of ground-nesting birds, etc. Predators also exert a selective pressure that, over evolutionary time, has shaped the wariness and graceful beauty of the prey. Thus, carnivores enact a vital and irreplaceable role in representing and maintaining the beauty and integrity of ecosystems. The absence of carnivores leads to simplification and impoverishment of the natural world.

Carnivores once occurred throughout much of North America. Over the past 100-200 years, however, the distribution and abundance of the larger carnivores in particular has decreased dramatically in the wake of spreading human population and enterprise (Paquet and Hackman 1995). Excessive killing and continuing loss and fragmentation of habitat has caused reductions in size, distribution, and connectivity of carnivore populations. As our society heads into the next millennium, one of our greatest challenges will be conservation of the wild hunters: the carnivores.

The Rocky Mountains from Yellowstone to the Yukon offer one of the last, best opportunities on the continent for conservation of carnivores. The section between Waterton Lakes-Glacier National Parks and Banff National Park (on both sides of the Continental Divide) is particularly important because here the mountains narrow and resource extraction is a major element in the ecology and economy.

In the heart of the Rocky Mountains, the North Fork of the Flathead River headwaters in southeast British Columbia and flows across the international border into northwest Montana – hence, it can be called the ‘Transboundary Flathead’ (Flathead Transboundary Network 2000). Over the past 20 years, the transboundary Flathead has been the locale for world-renowned research by Canadian and American scientists on the ecology of the larger carnivores and prey.

In this report, I assess the importance of the transboundary Flathead area for carnivore conservation. For each of five carnivore species – wolf, lynx, marten, wolverine, and grizzly bear — I have compiled and synthesized available information about its: (1) ecological resilience, (2) key food resources and habitats, and (3) distribution, movements, and relative abundance. Additionally, I present similar information for three key prey species – moose, elk, and white-tailed deer.

ASSESSMENT AREA

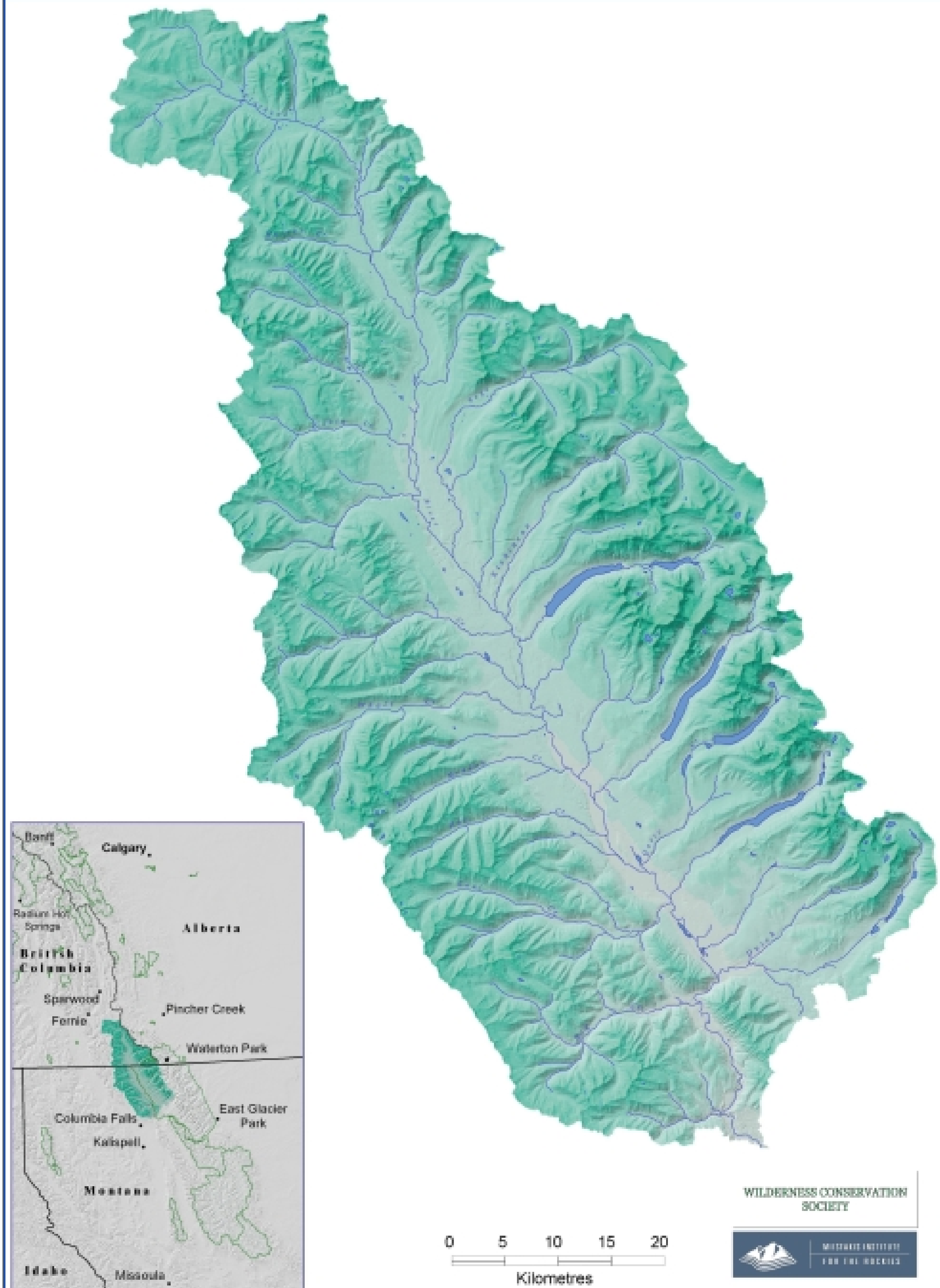
This assessment focuses on the transboundary Flathead (Fig. 1a & b). Here, the North Fork of the Flathead River flows southward 50 km (31 mi) in British Columbia and 76 km (47 mi) in Montana where it forms the western border of Glacier National Park. The watershed is 4134 km^2 (1590 mi^2) in size, with 38% of the landscape in B.C. and 62% in Montana.

The transboundary Flathead basin was formed in the early Tertiary period when Precambrian rocks slid east on the Lewis overthrust fault to form the Continental Divide. In the Pleistocene era, glacial action and erosion filled much of the valley with sediment, thereby creating the broad valley bottom and rolling topography of the present landscape (Alt and Hyndman 1973). The valley is framed on the east by the spectacular Clark/ Livingston Range (peaks up to 3000 m) and on the west by the lower, gentler McDonald/ Whitefish Range (peaks up to 2300 m). Elevation of the valley bottom ranges from 1400 m at the north end to 1000 m at the south end; the valley varies in width from 4 km to 10 km. This broad valley floor is important in the ecology of the carnivores there.

CARNIVORE CONSERVATION ASSESSMENT AREA
NORTH FORK OF THE FLATHEAD AND VICINITY

Fig. 1b

CARNIVORE CONSERVATION ASSESSMENT AREA
NORTH FORK OF THE FLATHEAD



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Climate of the transboundary Flathead reflects a convergence between warmer, moister systems coming in from the Pacific and drier, colder systems coming south from the Arctic. Winters are cold and snowy (average temperature in January of –9^0 C), while summers are cool and moist (average temperature in July of 16^0 C).

Flooding and fire have been important influences on the diverse communities of vegetation, herbivores, and carnivores in the transboundary Flathead. Cottonwood (*Populus trichocarpa*), spruce (*Picea* spp.), and willow (*Salix* spp.) characterize the floodplain; coniferous forests of lodgepole pine (*Pinus contorta*), Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), spruce, and subalpine fir (*Abies lasciocarpa*) dominate the upland areas; and patches of fescue (*Festuca* spp.) grasslands are scattered on the alluvial benches above the river (see Habeck 1970, Singer 1979, Jenkins 1985).

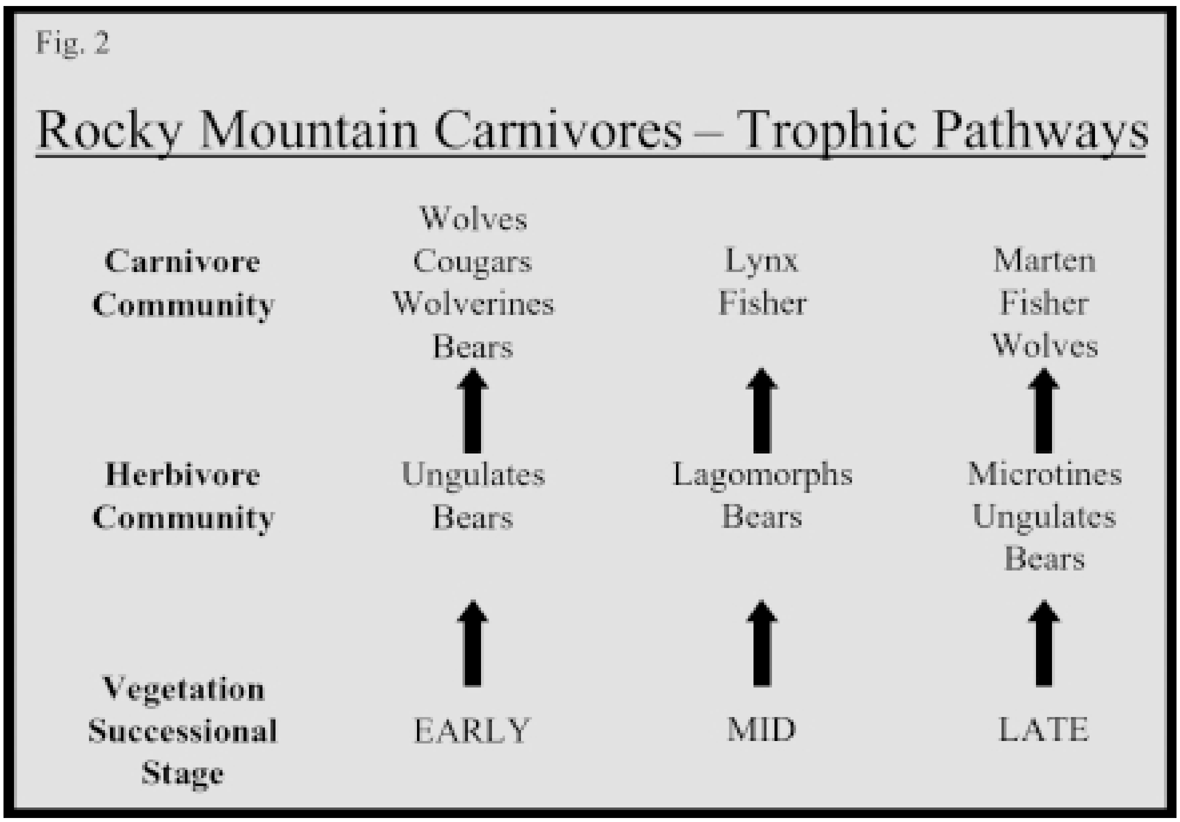
Due to the wide-ranging movements of the larger carnivores, it was important to place the transboundary Flathead watershed into larger geographic perspective. Thus, I also present information from several neighboring watersheds: the Wigwam River to the west (B.C. and Montana), the Castle River to the east (Alberta), and — across Highway 3 — the Bull and Elk Rivers to the north (B.C.) (Fig. 1a).

METHODS

Selection of Focal Species

Conservation planning can be enhanced through consideration of ecosystem structure and function along with specific needs of certain species (Noss 1990, Lambeck 1997). Carnivores may serve as useful focal species (Carroll et al. In Press) on the basis of their (1) position at the top of different pathways of energy flow, or food chains (‘ecological representation’), (2) large area requirements (‘umbrella’ effect), and (3) putative role in regulation of ecosystems (‘keystone’ effect). For example, wolves prey on ungulates (moose, elk, and deer) that often use early-succession plant communities; lynx prey on snowshoe hare that favor mid-succession (25-75 years following disturbance) stages;

and marten prey on small mammals (voles and squirrels) that are found in late-succession forests. Grizzly bears forage on plant and animal foods found in all three stages of the vegetation continuum (Fig. 2). The needs of many other species associated with these plant communities or habitats may be addressed by careful selection of a suite of carnivores that represents a broad range of ecological conditions at different spatial scales.



Another consideration is how *resilient* different species are to various kinds of human disturbance. Resilience refers to the capability of species for absorbing disturbance and still persisting (Holling 1973). Carnivores evolved in ecosystems where natural disturbances varied in frequency, intensity, duration, and extent — thereby resulting in different spatial and temporal patterns of change (Pickett et al. 1989). Over millennia, carnivores developed important behaviors and life history traits that imbued them with resilience to certain kinds and levels of disturbance (see Weaver et al. 1996 for development of this concept for carnivores).

Basic mechanisms of resilience exist at three levels: (1) individual — behavioral flexibility in foraging, (2) population — demographic compensation, and (3) metapopulation — dispersal. Behavioral flexibility in foraging refers to the capability of individuals to substitute one food for another in the face of environmental variability, thereby ameliorating flux in resource availability. Demographic compensation refers to the capability for responding to increased rates of juvenile and adult mortality with increased reproduction and/or survival, thereby mitigating demographic fluctuations. Successful dispersal is the mechanism by which vanishing local populations are 'rescued' from extirpation through connectivity of metapopulations. Dispersal by juvenile animals from their natal range is successful if the individual survives, establishes a new home range, finds a mate and reproduces.

In reference to human impacts upon wildlife, behavioral flexibility addresses the problem of habitat loss; demographic compensation, the problem of over-exploitation; and dispersal, habitat fragmentation at a landscape scale. Each species has a distinctive portfolio of resiliency that is critical to development and implementation of successful conservation strategies (Fig. 3).

Fig. 3

Resiliency of Rocky Mountain Carnivores

Mechanism	Grizzly Bear	Wolverine	Lynx	Marten	Wolf
Individual: Foraging Flexibility	Moderate	Moderate	Low	Low	Moderate
Population: Reproductive Compensation	Very Low	Very Low	Low	Moderate	High
Meta-Population: Dispersal for Recolonization	Very Low	Low	High	Moderate	High
Summary	Very Low →	Low →	Low →	Moderate →	High

Compilation and Synthesis of Information

During the past 20 years, the transboundary Flathead has been the locale for world-renowned research by Canadian and American scientists on the ecology of the larger carnivores and ungulates. I have compiled and synthesized information from the considerable body of reports, theses, and peer-reviewed publications and from direct interviews with key researchers and managers (see Literature Cited and Acknowledgments). For each of the focal carnivore species, I have provided a succinct profile of its resiliency along with local information (as available) on its distribution and movements, relative abundance, and use of key foods and habitats. Because information on ungulate species is relevant to several of the carnivores, I have presented similar information on moose, elk, and white-tailed deer.

With the able assistance of the Miistakis Institute in Calgary, I developed various maps that illustrate ranges and movements of both carnivores and ungulates across international and provincial borders. In several instances, I have assembled data from neighboring jurisdictions into (first-of-its-kind) transboundary maps. I have been mindful to acknowledge the original source of data for the maps and tables. Finally, I assume responsibility for any errors or omissions in the synthesis and interpretation of information presented herein.

CARNIVORE ASSESSMENT

Carnivore Community

A unique community of carnivore species resides in the transboundary Flathead region that appears unmatched in North America for its variety, completeness, use of valley bottomlands, and density of species which are rare elsewhere.

The following species occur there: grizzly bear (*Ursus arctos*), black bear (*Ursus americanus*), wolf (*Canis lupus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), cougar (*Puma concolor*), lynx (*Lynx canadensis*), bobcat (*Lynx rufus*), marten (*Martes americana*), fisher (*Martes pennanti*), wolverine (*Gulo gulo*), badger (*Taxidea taxus*), river otter (*Lontra canadensis*), mink (*Mustela vison*), and various weasels (*Mustela*. spp.). For this assessment, I selected a suite of carnivore species with large area requirements that (1) represent a wide breadth of environmental attributes (Carroll et al. In Press), and/or (2) exhibit low resiliency at one or more levels and thus are vulnerable to human impacts (Weaver et al. 1996). This suite includes wolf, lynx, marten, wolverine, and grizzly bear.

Wolf

Resilience

Gray wolves depend upon large mammals for their prey base but exhibit considerable flexibility in using different prey and habitats. Wolves living amidst the high ungulate diversity of the Rocky Mountains feed principally upon deer, elk, and moose. Individual female wolves have high reproductive capacity, but social behavior can limit successful breeding to one adult female per pack. Wolf populations with an adequate prey base appear capable of sustaining annual mortality rates of 20-40%. Wolves have dispersed upwards of 800 km, but success generally decreases inversely with distance. Wolves appear relatively tolerant of human activities, but humans account for 80-90% of wolf mortality. **Overall Resilience: High** (Fig. 3) (see Weaver et al. 1996).

Photo: courtesy of John Weaver

Key Food Resources and Habitats

Wolves in the lower transboundary Flathead (MT) have preyed in winter primarily upon white-tailed deer (71% of 387 kills) followed by elk (24%) and moose (5%) (combining data on 221 kills 1985-91 [Boyd et al. 1994] and 166 kills from 1992-96 [Kunkel et al. 1999]). During the initial years following wolf re-colonization of the North Fork, wolves preyed more on elk relative to white-tailed deer (1:2) than in latter years (1:6). Wolves killed the more vulnerable individuals (young-of-the year and older animals) in the prey population. In this area, cougars also preyed mostly on white-tailed deer (87%) and selected prey individuals similar in age, sex, and condition as those killed by wolves (Kunkel et al. 1999). Wolves in the upper Flathead (B.C.) appeared to use elk and moose more in addition to white-tailed deer (D. Boyd pers. comm.).

In the rugged topography of the Rocky Mountains, wolves select valley bottoms and lower slopes where they incorporate key wintering sites of ungulates (deer, elk, and moose) in their travels (Weaver 1994, Singleton 1995, Boyd-Heger 1997). Wolves use the valley bottom intensively from Sage Creek (B.C) down to Camas Creek – particularly areas east of the river (Fig. 4: Singleton 1995).

Distribution and Relative Abundance

Wolves re-colonized the transboundary Flathead in the early 1980's (see Ream et al. 1991). The population grew from one pack of 9 wolves during winter of 1982-83 to a maximum of 28 wolves in four packs in winter of 1992-93 (Ream et al. 1991, Pletscher et al. 1997, Kunkel 1997). The four packs ranged from Camas Creek on the south to the headwaters of the Flathead and Wigwam Flats on the north (Fig. 5). The number of wolves/packs has decreased in recent years.

After wolves colonized the transboundary Flathead, the area became an important source of dispersers who subsequently established numerous new packs elsewhere in British Columbia, Montana, and Alberta (Fig. 5) (Boyd et al. 1995, Boyd-Heger 1997, Boyd and Pletscher 1999). For example, in 1989, a female wolf (F8857) dispersed from the Flathead near Polebridge, Montana. She traveled north across the international border and up Sage Creek, B.C., and across the Continental Divide into Alberta. She continued north, crossed Highway 3, and moved up the Elk River valley, B.C. She paired with a male wolf dispersing from Spray Lakes area east of Banff National Park to establish a new pack in upper Highwood Creek, Alberta … 150 km north of her starting point. Several other female wolves dispersed from the transboundary Flathead eastward through the relatively low passes along the Continental Divide to establish new packs in Alberta, including in Waterton Lakes National Park. Many of these wolves in southwest Alberta were killed in winter 1994-95.

Fig. 4

COMPOSITE WOLF WINTER USE IN THE
NORTH FORK OF THE FLATHEAD, 1983-1994

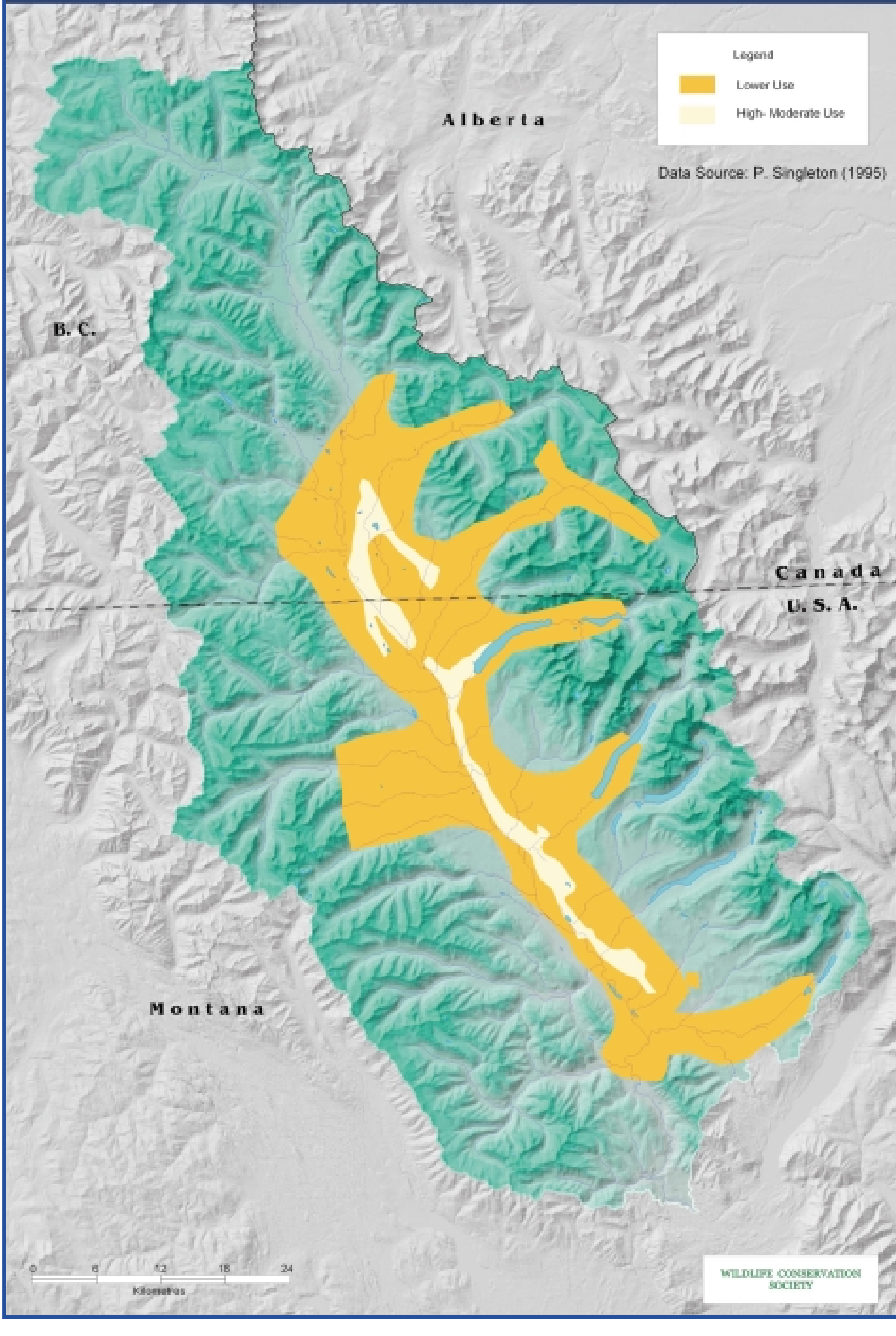


Fig. 5

COMPOSITE WOLF RANGE IN THE NORTH FORK OF THE FLATHEAD
DISPERSALS LEADING TO NEW PACKS
1983-1999

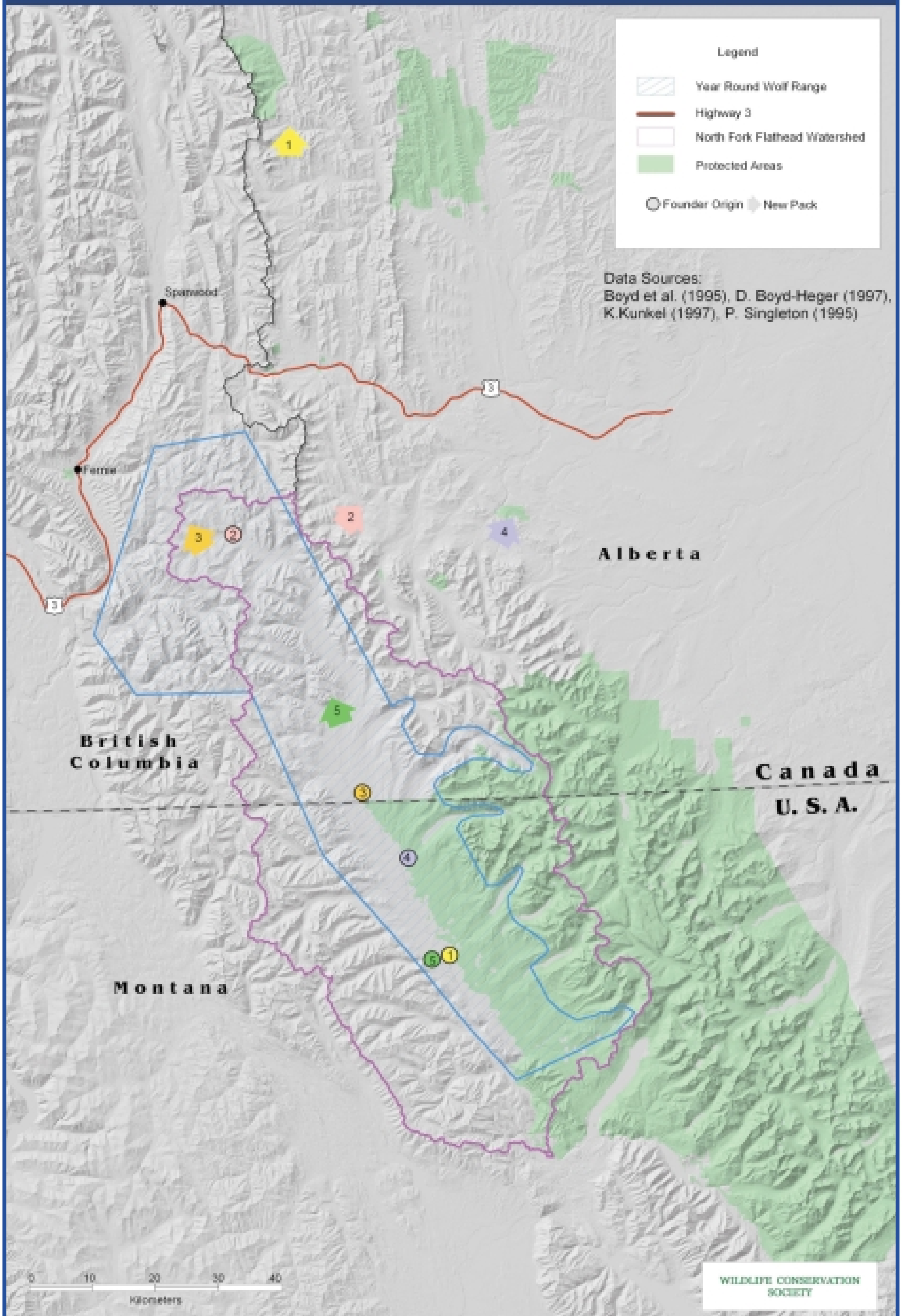


Photo: John Weaver

Lynx

Resilience

Lynx are specialized predators of snowshoe hare and exhibit relatively little flexibility in foraging behavior. In southern boreal and montane forests where snowshoe hares are relatively scarce and patchily distributed, lynx have low reproduction and cannot sustain high mortality rates. Lynx have moved astonishing distances (1000 km) but may be reluctant to cross major, 4-lane highways. Lynx appear tolerant of human activities but are vulnerable to trapping. **Overall Resilience: Low** (Fig. 3) (Koehler and Aubry 1994, Apps 2000).

Key Food Resources and Habitats

Although lynx in southern boreal and montane forests supplement their diet with red squirrels, distribution and relative abundance of lynx depends upon snowshoe hare. Hares occur in greater relative abundance in habitats with horizontal cover at 1 to 3 m above ground (Weaver 1993, Hodges 2000). Such structure can arise from dense stocking of coniferous saplings and poles (notably lodgepole pine and spruce) in early to mid-succession (20-50 years old) stands or from low lateral branches of subalpine fir or shrub understories in late-succession coniferous stands (Koehler and Brittell 1990, J. Weaver, unpublished data). Lynx in the western mountains have used late-succession spruce forests with many large logs for denning (Koehler 1990). Prime lynx habitat (areas with at least moderate abundance of snowshoe hare at mid-elevations with moderate slopes) is patchily distributed in the Rocky Mountains (Apps 2001, Carroll et al. In Press).

Distribution and Relative Abundance

Lynx occur in both the B.C. and Montana sections of the transboundary Flathead. Over the past 15 years, the Elk River area north of the Flathead has accounted for 62% of the lynx trapped in the area (Table 1). Recent modelling of lynx occurrence in southeast B.C. by Clayton Apps predicts a very high probability of occurrence in the Flathead, Elk, and upper portions of the Bull and Wigwam watersheds (Apps 2001).

Table 1. Number of lynx trapped per year in the North Fork of the Flathead River and adjacent watersheds, British Columbia, Montana, and Alberta, 1985-86 to 1999-2000.

	NF Flathead		Wigwam		Bull	Elk	Castle	
Year	BC	MT	BC	MT	BC	BC	AB	TOTAL
85-86	0	0	1	1	1	11	5	19
86-87	0	0	0	2	0	8	2	12
87-88	1	0	1	0	2	11	0	15
88-89	0	0	0	1	0	14	1	16
89-90	0	0	0	0	3	18	2	23
90-91	0	0	0	0	0	4	2	6
91-92	0	1	0	1	0	10	n.d.	12
92-93	0	0	0	0	2	10	n.d.	12
93-94	0	0	0	0	0	1	5	6
94-95	0	2	0	2	0	3	5	12
95-96	0	0	0	0	1	1	3	5
96-97	0	0	0	0	2	2	4	8
97-98	1	0	0	0	0	1	0	2
98-99	0	0	0	0	0	3	5	8
99-00	0	0	0	0	0	3	2	5
Total	**2**	**3**	**2**	**7**	**11**	**100**	**36**	**161**

Data sources: Bill Warkentin, BC MELP, Cranbrook; Tim Thier, MT FWP, Kalispell; and Jim Clark, AB NRS, Pincher Creek. n.d. = no data.

Marten

Resilience

Martens use late-succession stands of mesic coniferous forests that provide structural elements key to foraging and denning (Buskirk and Powell 1994). Conventional clear-cut logging destroys these prime habitats for several decades, and martens have little flexibility in the face of such habitat loss (Thompson and Harestad 1994). Martens have a moderate reproductive capacity in suitable habitats. Little is known about dispersal in martens, but their preference for overhead cover and small body size would suggest a vulnerability to forest fragmentation at smaller scales. Martens are easily trapped and may be vulnerable to over-harvest by trappers if habitat capability is not maintained. **Overall Resilience: Moderate** (Fig. 3).


Photo: Susan Morse

Key Food Resources and Habitats

Martens prey principally upon red-backed voles (*Clethrionomys* spp.), pine squirrels (*Tamiasciurus* spp.), and voles (*Microtus* spp.). Red-backed voles are most abundant in mature/old-growth, mesic stands of conifers (particularly Engelmann spruce) characterized by dense canopy and large-diameter trees, snags, and logs (Hayes and Cross 1987, Nordyke and Buskirk 1991). Pine squirrels are restricted mostly to cone-producing stages (late-succession) of coniferous forests (Flyger and Gates 1982).

Meadow voles occur in herbaceous and shrub meadows in mesic forest or riparian sites. Late-succession stands of mesic forests with a complex structure of leaning and down logs at the forest floor provide access for marten to prey under snow and a warmer microenvironment in winter. Large live trees and snags provide security from predators for natal and maternal denning (Buskirk and Ruggerio 1994).

In the transboundary Flathead, major wildfires in the 1930s and salvage logging of Engelmann spruce (in response to spruce bark beetle infestations) in the 1950-60s reduced the amount of late-succession forests for marten and other species. The full effect of this habitat loss and fragmentation upon demography, genetics, and population viability of martens remains unknown.

Distribution and Relative Abundance

At present, patches of suitable marten habitat are small and widely scattered throughout the North Fork of the Flathead, with the most significant patches remaining in Kishinena-Akamina, Sage, Leslie, Cabin, and Shepp Creeks in British Columbia (Fig. 6). The Montana Department of Fish, Wildlife, and Parks (FWP) has long considered the North Fork of the Flathead/Whitefish Range as the top area in the state for martens and other 'furbearers' (T. Thier, pers. comm.). Over the past 15 years, trappers have taken/ sold an average of 216 marten per year (range: 144 - 397) from the Montana and B.C. portions of the Flathead (Table 2). This combined harvest is the highest of any of the major watersheds in the region; the Elk River area north of the Flathead in B.C. is next with an average of 154 marten reported per year (range: 64 – 251). Because of the susceptibility of martens to trapping and the continuing loss/fragmentation of late-succession coniferous habitats, numerous researchers have emphasized the importance of protected refugia to the conservation of martens (Strickland 1994).

Fig.6

MARTEN HABITAT (SPRUCE FOREST) IN THE NORTH FORK OF THE FLATHEAD

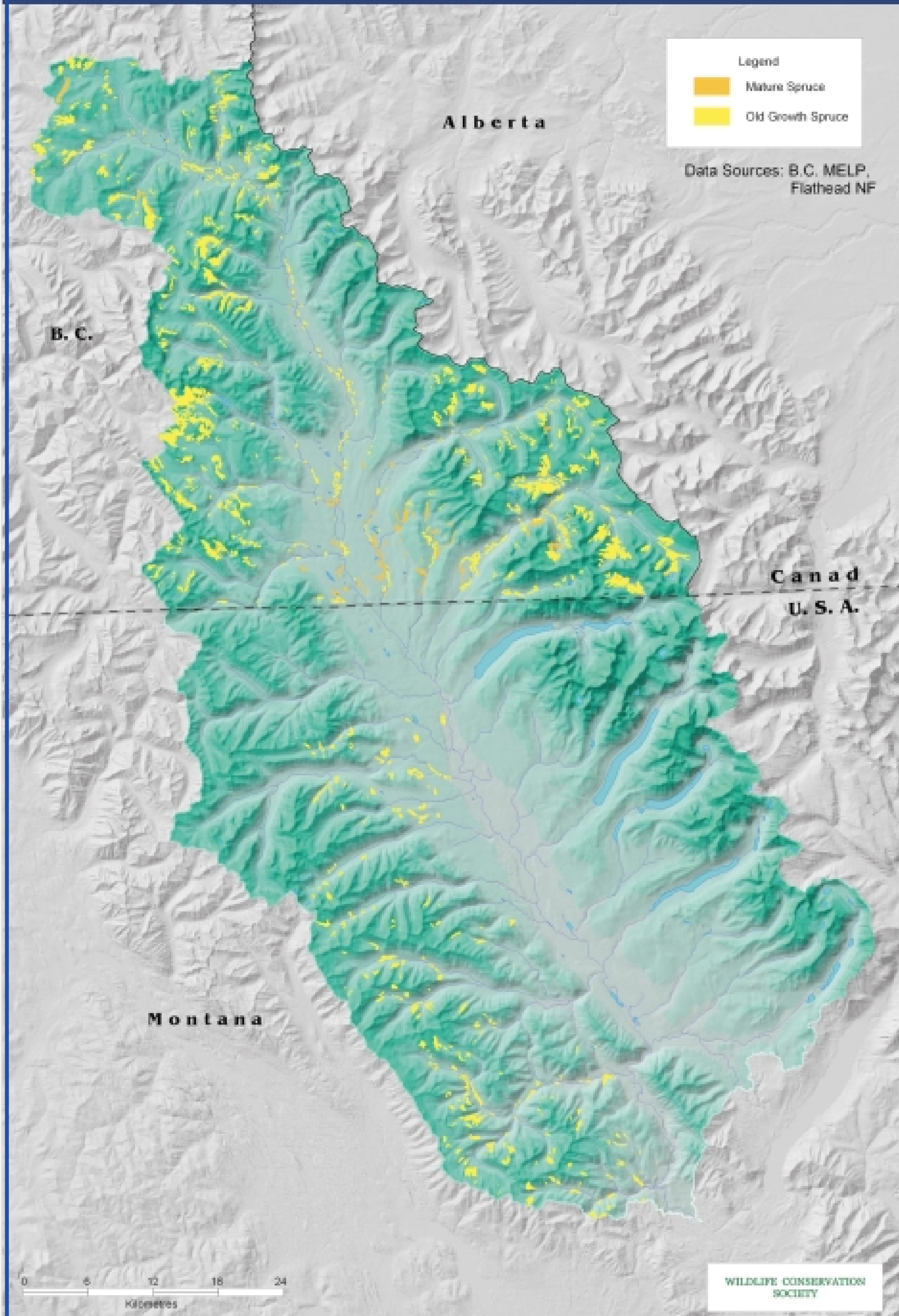


Table 2. Number of martens trapped per year in the North Fork of the Flathead River and adjacent watersheds, British Columbia, Montana, and Alberta, winters 1985-1986 to 1999-2000.

	NF Flathead		Wigwam		Bull	Elk	Castle	
Year	BC	MT	BC	MT	BC	BC	AB	TOTAL
85-86	77	n.d.	21	n.d	54	235	63	450
86-87	44	n.d	39	n.d	80	251	61	475
87-88	127	n.d	28	n.d	171	187	35	548
88-89	65	n.d	25	n.d	152	151	43	436
89-90	57	125	16	27	93	194	36	548
90-91	53	97	28	20	52	93	43	386
91-92	143	254	29	60	106	182	n.d.	774
92-93	81	n.d.	23	n.d.	71	168	n.d.	343
93-94	32	112	8	25	59	64	50	350
94-95	73	210	40	63	46	180	31	643
95-96	72	n.d.	18	n.d.	73	101	62	326
96-97	56	112	18	88	64	129	62	529
97-98	106	132	62	22	68	134	63	587
98-99	64	137	11	51	83	76	31	453
99-00	94	79	43	46	88	158	55	563
Total	**1144**	**1258**	**409**	**402**	**1260**	**2303**	**635**	**7411**
x/yr	**76**	**140**	**27**	**45**	**84**	**154**	**49**	**575**

Data sources: Bill Warkentin, BC MELP, Cranbrook; Tim Thier, MT FWP, Kalispell; and Jim Clark, AB NRS Pincher Creek. n.d. = no data.

Wolverine

Resilience

Photo: John Weaver

In summer, wolverines use a wide variety of foods but seem to subsist in winter largely on ungulate carrion. Wolverines have a very low reproductive rate (0.5-0.7 kit/adult female/year) which may reflect the tenuous nutritional regime for this scavenger; consequently, wolverines may not be able to sustain mortality rates >7%. Both the diversity of foods and availability of ungulate carrion appear important to the distribution, survival, and reproductive success of wolverines. Young females often establish home ranges within or adjacent to their mother’s range. Wolverines appear sensitive to human disturbance (particularly during denning period) and vulnerable to trapping. **Overall Resilience: Low** (Fig. 3) (see Hatler 1989, Banci 1994, Weaver et al. 1996 for reviews).

Key Food Resources and Habitats

In the South Fork of the Flathead in Montana, Hornocker and Hash (1981) reported that wolverines fed predominately upon ungulate carrion at lower elevations in winter and early spring; in summer, wolverines moved upward in elevation to subalpine basins where they may have preyed heavily on ground squirrels. In searching for various foods, wolverines use a variety of habitats.

Distribution and Relative Abundance

Wolverines occur throughout the transboundary Flathead. Montana FWP has long considered the North Fork of the Flathead/Whitefish Range as the top area for wolverines (T.Thier, pers. comm.). Over the past 15 years, trappers have taken/sold 24 wolverines (range: 0-6/year) from the Montana and B.C. portions of the Flathead (Table 3). This combined harvest is the second-highest of any of the major watersheds in the region behind the Wigwam River area (total = 35; range: 0-7) west of the Flathead and similar to the Elk River area (total = 23; range: 0-4) north of the Flathead. Trapping pressure upon wolverines in the region appears to have subsided in recent years.

Table 3. Number of wolverines trapped per year in the North Fork of the Flathead River and adjacent watersheds, British Columbia, Montana, and Alberta, winters 1985-1986 to 1999-2000.

	NF Flathead		Wigwam		Bull	Elk	Castle	
Year	BC	MT	BC	MT	BC	BC	AB	TOTAL
85-86	3	3	0	7	1	4	0	18
86-87	1	0	0	0	1	3	0	5
87-88	0	1	1	2	3	1	1	9
88-89	0	0	2	0	1	1	0	4
89-90	1	0	1	1	1	1	0	5
90-91	1	0	0	2	1	4	1	9
91-92	1	0	0	0	1	3	n.d.	5
92-93	6	0	3	0	2	1	n.d.	12
93-94	2	0	3	3	1	0	2	11
94-95	0	1	0	1	1	1	0	4
95-96	0	1	0	4	0	0	0	5
96-97	0	2	0	4	0	0	1	7
97-98	0	1	0	1	0	1	1	4
98-99	0	0	0	0	0	2	0	2
99-00	0	0	0	0	4	1	0	5
Total	**15**	**9**	**10**	**25**	**17**	**23**	**6**	**105**

Data sources: Bill Warkentin, BC MELP, Cranbrook; Tim Thier, MT FWP, Kalispell; and Jim Clark, AB NRS, Pincher Creek. n.d. = no data.

Grizzly Bear

Resilience

Although grizzly bears use a wide variety of foods, in many interior areas of North America they rely upon berries in late summer for weight gain and fat deposition necessary for successful hibernation and reproduction. During years of poor berry production, bears move widely in search of alternative foods that can bring them into contact with humans and increased risk of mortality. Grizzly bears have a very low reproductive rate (0.5-0.8 cubs/adult female/year) and cannot compensate with higher reproduction for increased mortality. Hence, low mortality of adult females is critical to the persistence of grizzly bear populations. (Recent grizzly bear management programs have set upper limits of known mortality of female bears by humans at 1-2% of the estimated population.) Increased vehicle access by humans can displace some grizzly bears up to 1 km and lead to greater mortality by poaching. Sub-adult females do not disperse far, often establishing a range within or adjacent to their mother's home range. **Overall Resilience: Low** (Fig. 3) (see Weaver et al. 1996).

Key Food Resources and Habitats

In the Flathead area, key foods for grizzly bears include: (1) ungulates (elk and moose) and hedysarum (*Hedysarum sulphurescens*) roots in the early spring, (2) grasses, horsetails (*Equisetum arvense*), and cow parsnip (*Heracleum lanatum*) later in spring and early summer, (3) huckleberries (*Vaccinium* spp.) and buffaloberries (*Shepherdia canadensis*) in late summer, and (4) berries, ungulates, and hedysarum roots in fall (McLellan and Hovey 1995). The Flathead and adjacent Waterton Lakes National Park are the only bear study areas in North America that have all major bear foods found across the interior of the continent (Hamer et al. 1991, McLellan and Hovey 1995). The presence of both species of berries ameliorates fluctuation in availability of this key food and provides important stability in foraging opportunity.

In spring, most grizzly bears in the Flathead move down to the broad valley where they find many key foods in riparian habitats; other bears remain in the mountains and find spring foods in avalanche chutes. Later in summer, bears feed intensively for huckleberries in sites at 1700-2000 m elevation that were burned 50-70 years previously and/or for buffaloberries in open timber burns at various elevations. In the fall, many bears again use the broad riparian areas along the Flathead River for various foods (McLellan and Hovey 2001). Large clear-cuts in the Flathead produce little bear food (Knight 1999), and bears rarely use them (McLellan and Hovey 2001).

Due to the vulnerability of grizzly bear populations (especially adult females) to excessive killing by humans, *security areas* (areas >500 m from high-use roads/trails and >9 km^2 in size: *sensu* Mattson 1993) can be considered vital ‘habitats’. Recent studies have determined that security areas comprised an average of 68% of the home range of adult females (Mace and Waller 1997, Gibeau et al. In Press).

Distribution and Relative Abundance

The highest density of grizzly bears (65-80 bears/1000 km^2) recorded anywhere in interior North America occurs in the Flathead (McLellan 1989, B. McLellan, pers. comm.). In Glacier National Park, very high concentrations of grizzly bears have been observed in the floodplain of the Flathead River (Singer 1978) and detected in areas along the Continental Divide during recent DNA-based surveys (Kendall et al. 2001). This extraordinary density may be attributed to the diversity, extent, and productivity of the berry species and riparian sites (McLellan and Hovey 2001). Moreover, the B.C. section of the Flathead River is especially unique as bears can use the low-elevation valley that remains unsettled by humans. Grizzly bears also occur at high density (>50 bears/1000 km^2) throughout the larger region, including the Wigwam, Bull, Elk, and Castle watersheds (Fig. 7).

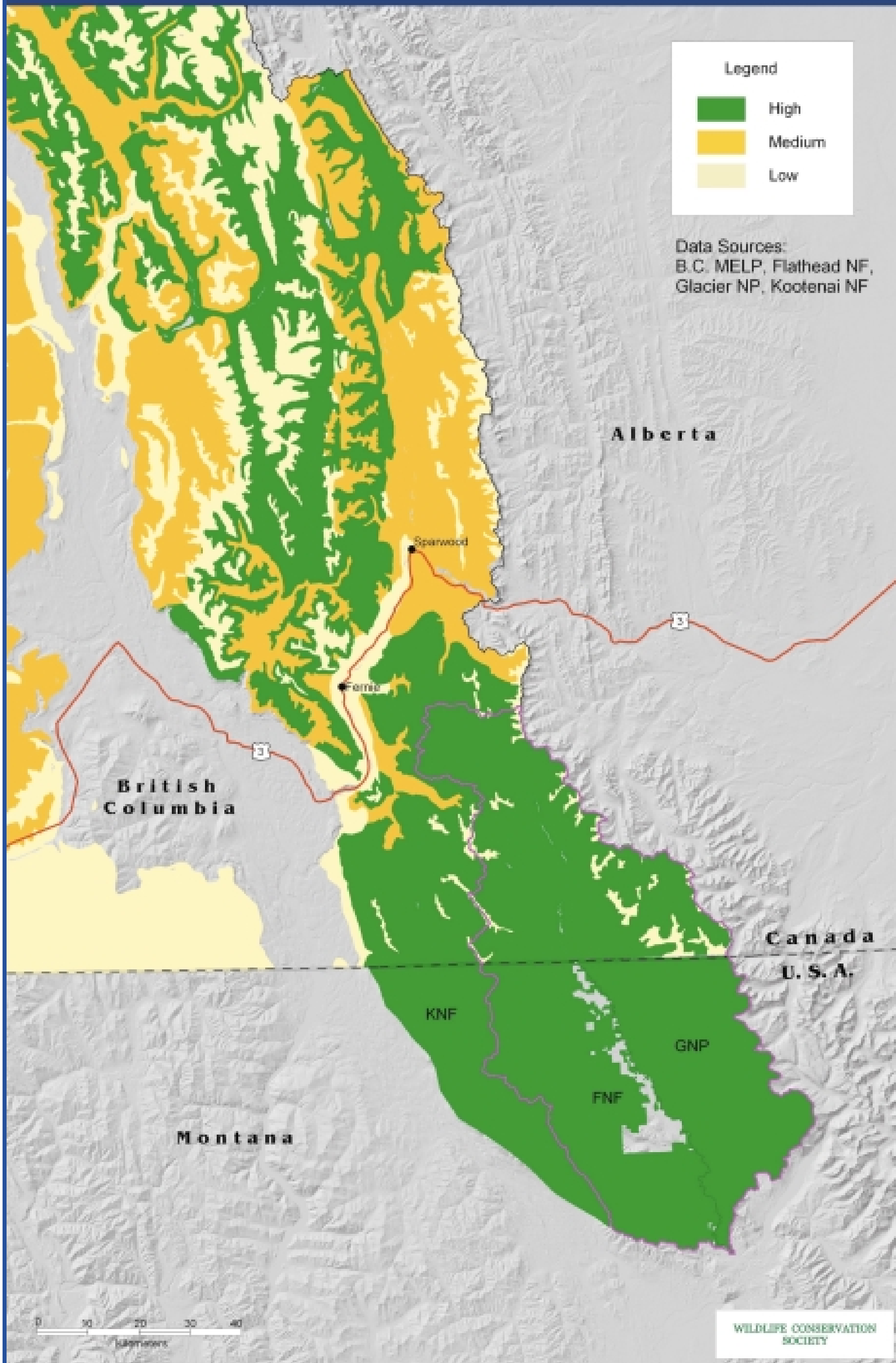
Transboundary movements by grizzly bears have been documented: (1) from the Flathead River and Elk River valleys in B.C. across the Continental Divide to southwest Alberta, (2) B.C. and Montana sections of the Flathead, and (3) across Highway 3 (Mowat and Strobeck 2000, B. McLellan /R. Quinlan pers. comm.). The transboundary Flathead is a source for grizzly bear populations in the larger region.

UNGULATES

Several species of ungulates occur in the transboundary Flathead, including moose (*Alces alces*), elk (*Cervus elaphus*), white-tailed deer (*Odocoileus virginianus*), mule deer (*O. hemionus*), bighorn sheep (*Ovis canadensis*), and mountain goat (*Oreamnos americanus*). Here, I focus on moose, elk, and white-tailed deer because they provide important food resources for many of the carnivore species. These cervids partition their use of the North Fork Flathead environment in winter on the basis of snow-depth, vegetation, and physiography (Singer 1979, Jenkins 1985, Jenkins and Wright 1987).

Fig. 7

RELATIVE ABUNDANCE OF GRIZZLY BEARS IN THE NORTH FORK OF THE FLATHEAD AND VICINITY



Moose

Key Habitats and Food Resources

In winter, moose select the ecotone of riparian shrub and old-growth spruce habitats along the Flathead River and some tributaries where they feed on red-osier dogwood (*Cornus stolonifera*), willow (*Salix* spp.), and subalpine fir (*Abies lasiocarpa*) (Jenkins 1985). Moose use these habitats at higher elevations in the upper North Fork where deep snow typically precludes winter use by elk and white-tailed deer. In mild winters, moose may use cutover spruce stands and burns (>10 years old) and lower reaches of avalanche chutes with high densities of shrubs (Jenkins 1985, Halko et al. 2000). In severe winters, mature/old-growth stands of spruce and Douglas fir with >70% canopy closure along the Flathead River provide critical habitat for moose, elk, and white-tailed deer as they increase their use of coniferous browse (Jenkins 1985).

Distribution, Movements, and Relative Abundance

Moose occur throughout the transboundary Flathead. In winter, they concentrate along the riparian bottomland of the main stem of the North Fork and short distances up some of the tributaries such as Kishinena, Sage, Commerce, Cabin, and Cauldrey Creeks (Fig. 8). Moose also use some upland sites such as Whale Buttes (T. Thier, pers. comm.) and Trachyte Ridge (B. Warkentin pers.comm.). During the mild winter of 1999-2000, Halko et al. (2000) observed many moose wintering at 1680-2075 m elevation .

Langley (1993) reported that some female moose that wintered in the lower North Fork of the Flathead in Montana migrated in spring/summer upwards of 84 km to higher elevation habitats in B.C., including the upper reaches of Cauldrey, Cabin, and Howell Creeks on the west side of the Flathead and upper Sage and Middlepass Creeks on the east side (Fig. 9). Some of these moose crossed the Continental Divide through South and Middle Kootenay Passes into Alberta (Langley 1993). All of the migratory moose returned to the same summer and winter ranges each year.

Fig. 8

MOOSE WINTER RANGE IN THE NORTH FORK OF THE FLATHEAD

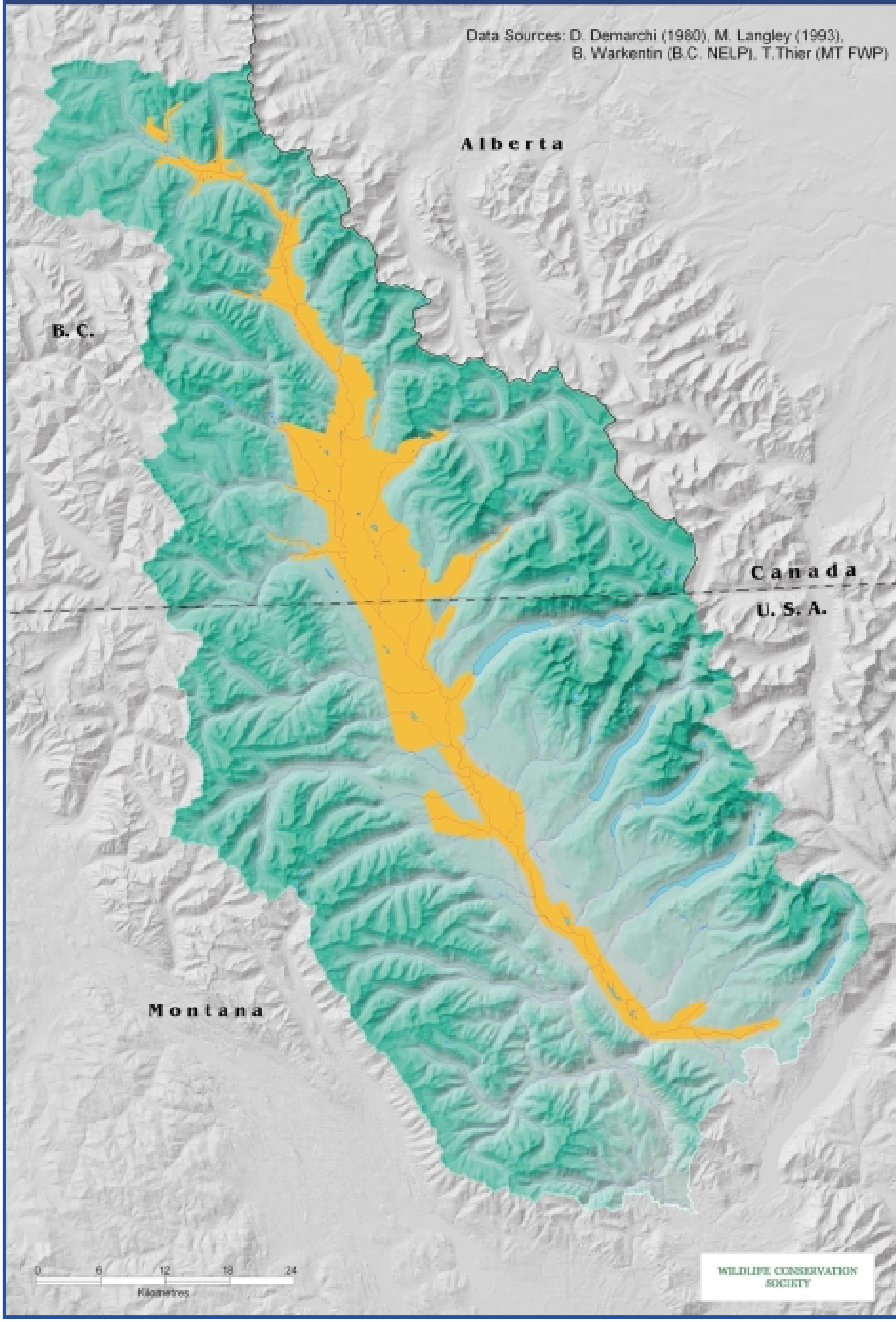
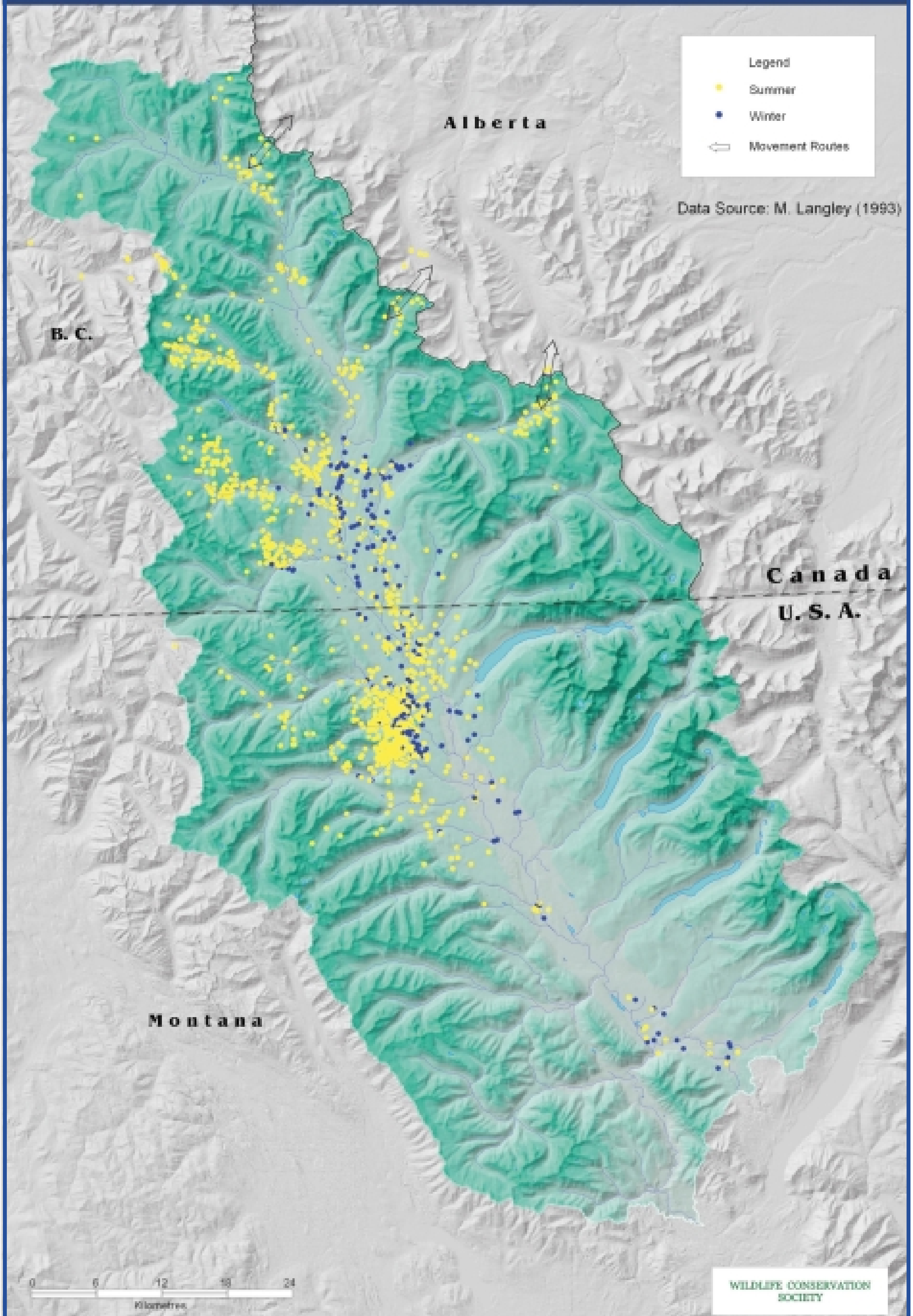


Fig. 9

SEASONAL LOCATIONS OF FEMALE MOOSE
IN THE NORTH FORK OF THE FLATHEAD 1990-1992



Moose occur in moderate abundance in the transboundary Flathead, particularly on the British Columbia side. For the winter of 1974-75, Singer (1975) reported 40 moose in the area between Kishanehn Creek and Commerce Creek. For the winter of 1999-2000, Halko et al. (2000) observed 98 moose in a 232-km^2 survey area (0.42 moose/km^2) in the B.C. portion of the Flathead and provided a 'conservative' estimate (using 70% sightability) of 160 animals. Of nine Management Units in the East Kootenays surveyed for moose, the Flathead (M.U. 4-01) had the second-highest density (0.45 moose/km^2) behind the adjacent Wigwam (M.U. 4-02) (0.69 moose/ km^2) (Halko et al. 2000). The Elk River (M.U. 4-23) north of the Flathead comprised approximately 40% of both the moose winter range and the estimated population of 1458 moose in the East Kootenays.

The population of moose in the B.C. section of the Flathead may have declined slightly over the past decade. The density of moose classified during winter aerial surveys decreased from 0.49/km^2 in 1991 to 0.42/km^2 in 2000 while the calves/100 cows declined from 23 to 15 (Halko et al. 2000). In the Montana section, however, 30-35 calves/100 cow moose were classified in 2000 (T. Thier, per. comm.).

Elk

Key Habitats and Food Resources

Elk use a variety of habitats and elevations depending upon winter severity (Singer 1979, Jenkins 1985, Bureau 1992, Kunkel 1997). In mild winters, elk use grasslands, riparian zones, ridges and south-facing slopes, and lodgepole pine savannahs where they feed on sedges (*Carex* spp.), various grasses, and red-osier dogwood. In more severe winters, elk select for mature/old-growth stands of spruce with dense overstory and abundant shrubs along the Flathead River where they feed on the dogwood, serviceberry (*Amelanchier alnifolia*), and conifers.

Distribution, Movements, and Relative Abundance

In winter, elk occur mainly on the lower transboundary Flathead in Montana; important sites include Abbotts Flats, Round Prairie-lower Mud Creek, Big Prairie-lower Akokala Creek, Hay Creek marsh, and Sullivan Meadow (Figs. 10, 11) (Bureau 1992, Kunkel 1997). In milder winters, a few dozen elk occur along the east side of the Flathead River in B.C. up to about Commerce Creek, in lower Kishinena and Sage Creeks, and on lower slopes of Miskwasini Peak and Commerce Peak (Singer 1975, Bureau 1992, D. Boyd, pers. comm., B. Warkentin, pers. comm.).

Bureau (1992) reported that 80-85% of the radio-collared female elk (n = 20-21) that wintered in the lower transboundary Flathead in Montana migrated in spring and early summer upwards of 91 km to higher elevation habitats in B.C., including the upper reaches of Cauldrey Creek, Cabin Creek/Inverted Ridge, Howell and 29-mile Creeks, and the headwaters of the North Fork at McEvoy Creek-Limestone Ridge (Fig. 11). In years with less snow remaining in late May, elk calved in subalpine areas; in harsher years, they dropped their calves in dense lodgepole pine forests in the main valley of the Flathead or lower tributaries in British Columbia (Bureau 1992). Some elk that winter in Carbondale and Castle Creeks in Alberta cross the Continental Divide through North, Middle, and South Kootenay Passes to summer on the British Columbia side in the upper Flathead (Fig.11) (Morgantini 1993). Elk appeared to use the same summer range each year (Bureau 1992).

Elk are moderately abundant in the transboundary Flathead. Based on aerial surveys in January, Bureau (1992) estimated the elk population to be 369 (95% confidence limits of 346-394) in 1991 and 508 (95% confidence limits of 431-619) in 1992. On two aerial surveys in April, 1992, he counted 262 and 292 elk whereas Singer (1979) counted 210 elk in April 1975.

Fig. 10

ELK WINTER RANGE IN THE NORTH FORK OF THE FLATHEAD

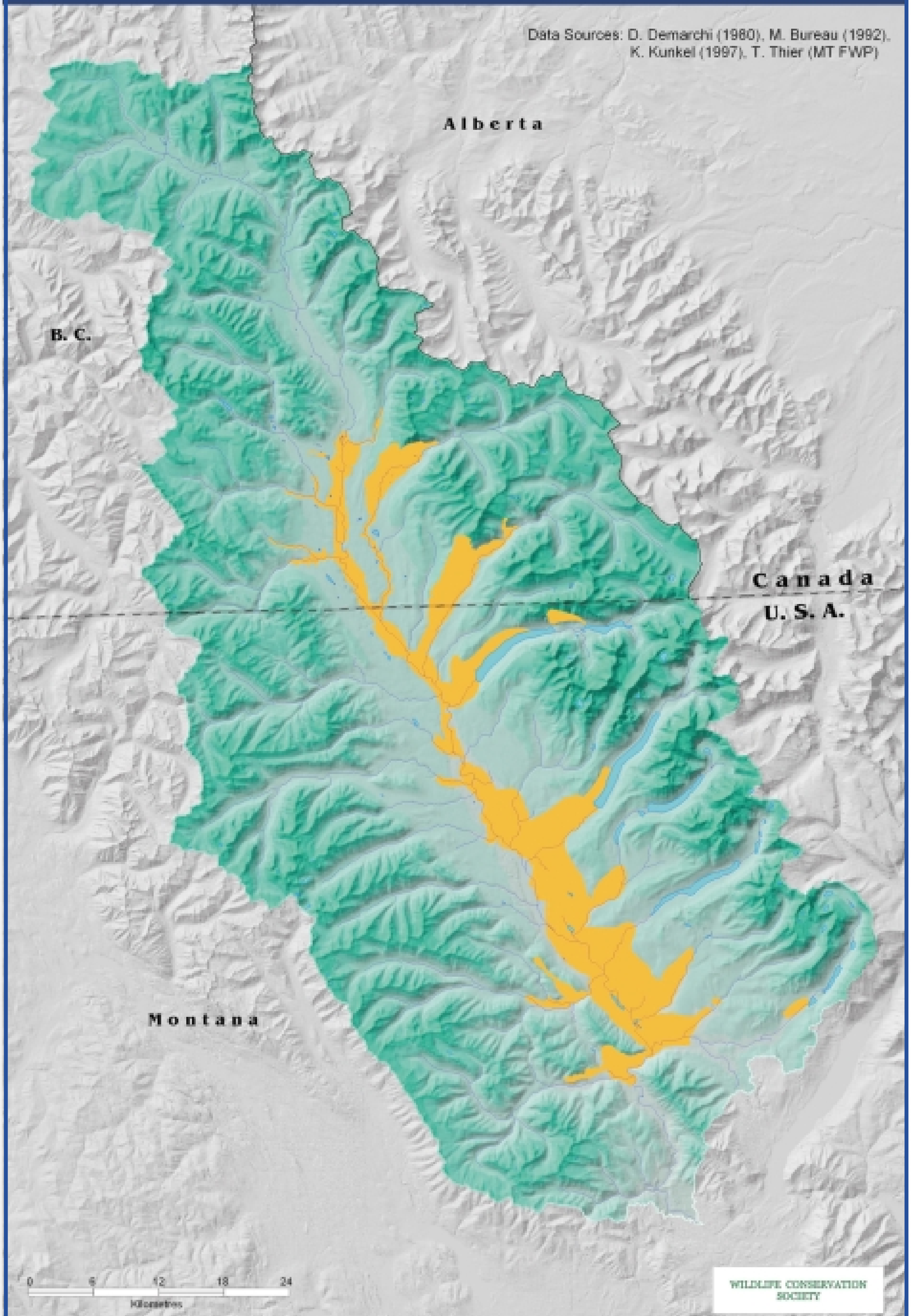
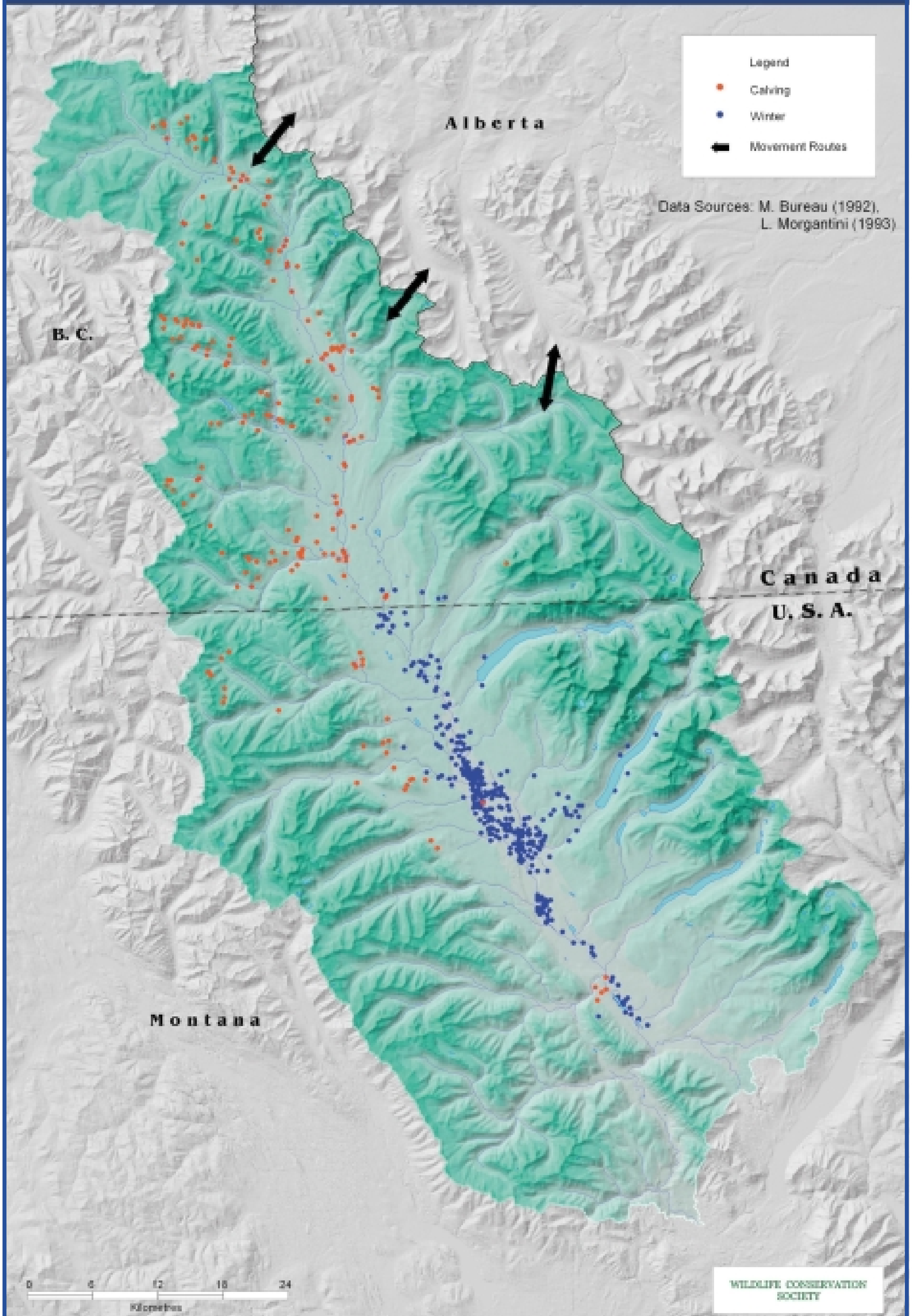


Fig. 11

SEASONAL LOCATIONS OF FEMALE ELK
IN THE NORTH FORK OF THE FLATHEAD 1990-1992



White-tailed Deer

Key Habitats and Food Resources

In winter, white-tailed deer select mature/old-growth stands of spruce, cottonwood, and Douglas fir in the floodplain and adjacent slopes in the lower section of the North Fork (Montana) where the snow-pack averages <40 cm (16 in) in depth (Singer 1979, Jenkins 1985, Rachael 1992). Deer feed on conifers (Douglas fir, lodgepole pine, and subalpine fir), deciduous shrubs (red-osier dogwood and serviceberry), and evergreen plants (Oregon grape [*Berberis repens*]). Although white-tailed deer use a variety of open habitats from spring to fall, the valley bottom along the North Fork remains important, particularly for fawning sites.

Distribution, Movements, and Relative Abundance

In winter, white-tailed deer occur mainly on the east side of the lower transboundary Flathead in Montana; important sites include lower Kishenehn Creek, the north shore of Kintla Lake, confluence of Kintla Creek and the North Fork, Polebridge to Bowman Lake, lower Big Creek, and lower Quartz Creek-Sullivan Meadows (Fig. 12) (Rachael 1992, Kunkel 1997). Several white-tailed deer that wintered at Kintla Lake migrated north into B.C. as far as Harvey Creek (distance of 40 km) (Fig. 13) (Rachael 1992). White-tailed deer appeared to use the same seasonal range each year.

Actual number of white-tailed deer in the North Fork has not been estimated because it is difficult to survey deer reliably from the air in forested landscapes. Singer (1979) counted 116 white-tailed deer May 1975. The population of white-tailed deer in the North Fork may have declined in recent years due to the severe winter of 1996-97, predation, and perhaps hunter harvest of does.

Fig. 12

W-T. DEER WINTER RANGE IN THE NORTH FORK OF THE FLATHEAD

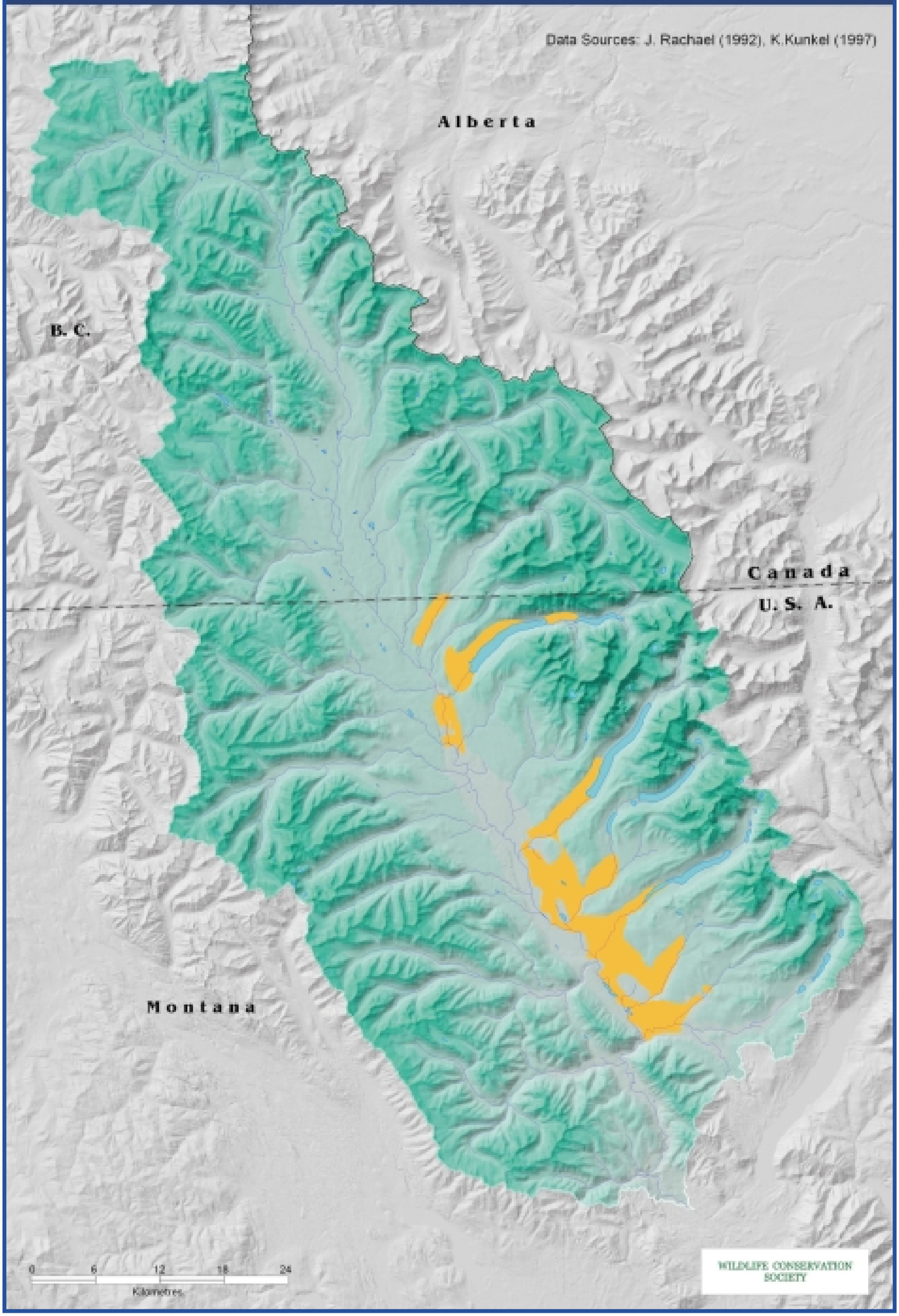
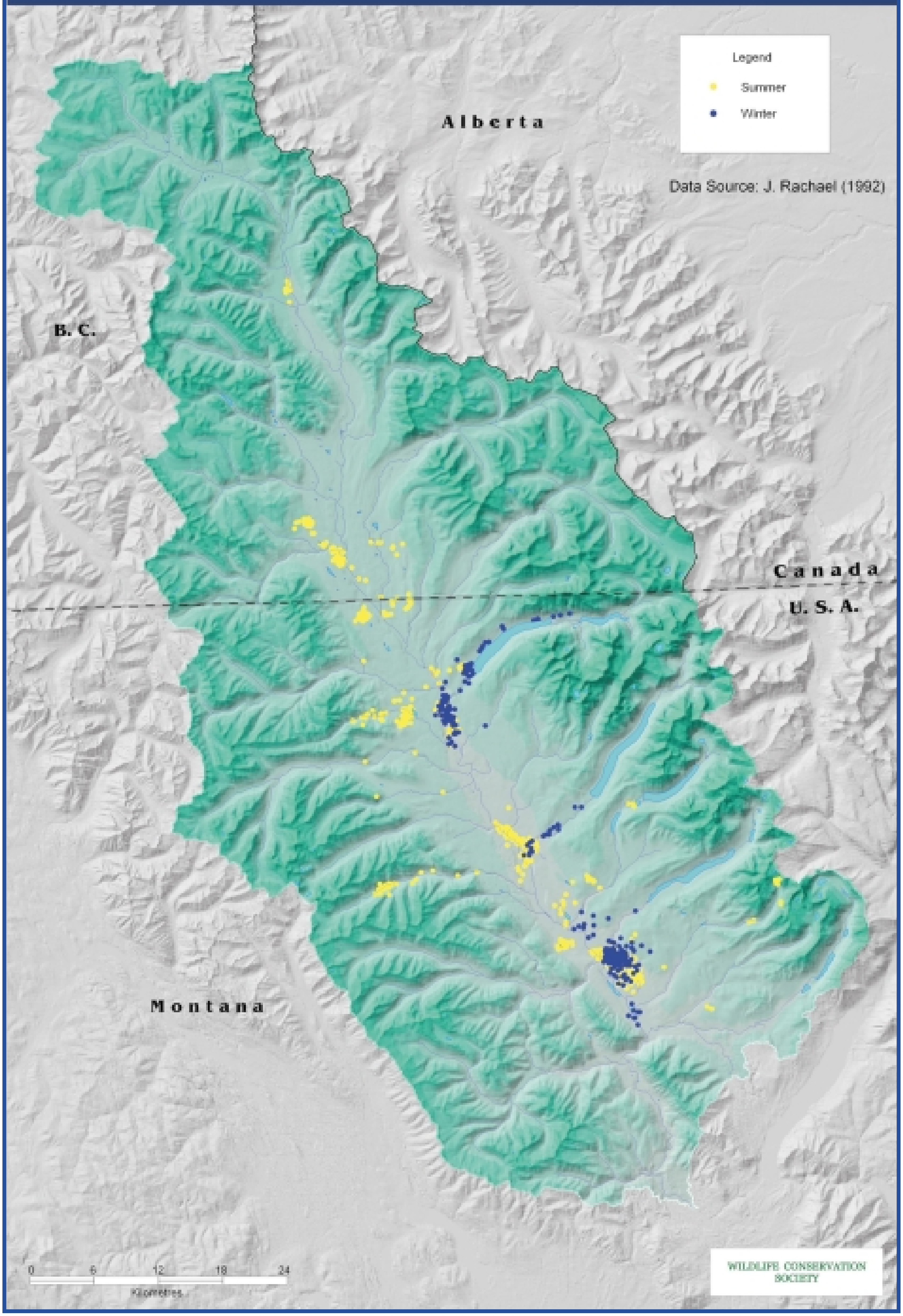


Fig. 13

SEASONAL LOCATIONS OF FEMALE W-T. DEER IN THE NORTH FORK OF THE FLATHEAD 1990-1991



CONCLUSIONS

- Many wildlife move across the international border making the Flathead River basin of British Columbia and Montana truly a transboundary landscape that must be managed as one integral, ecological unit.

Numerous scientific studies have documented movements by many wildlife across both the international and inter-provincial boundaries (see Maps and Literature Cited). Moose, elk, and (to a lesser extent) white-tailed deer that winter along the lower transboundary Flathead River in Montana migrate up the valley in summer upwards of 90 km to various areas in the upper basin in British Columbia. Some of the moose move occasionally even into the Castle River area in Alberta. Elk and deer may move from winter ranges in Alberta to summer ranges in British Columbia. Carnivores such as wolves and grizzly bears also move back and forth between British Columbia, Montana, and Alberta. The valley of the transboundary Flathead River is a primary north-south thoroughfare whereas passes along the Continental Divide at the head of Middlepass Creek and Sage Creek facilitate east-west movements. It is truly a transboundary basin.

- A unique community of carnivore species resides in the transboundary Flathead region that appears unmatched in North America for its variety, completeness, use of valley bottomlands, and density of species which are rare elsewhere.

The transboundary Flathead appears unique in North America for its variety, completeness, and density of carnivores that are rare elsewhere. At least 16 species of carnivores occur there and none are missing. Density of grizzly bears is the highest recorded anywhere in the interior of North America; wolves and cougars have been at high densities. Another unique aspect is that these large carnivores can use important food resources in the valley bottomlands; elsewhere, human settlements in valleys preclude large carnivores from such natural behavior.

- Due to these unique characteristics and its strategic position as a linkage between National Parks in both countries, the transboundary Flathead may be the single most important basin for carnivores in the Rocky Mountains.

With its outstanding richness and abundance of carnivore species, the transboundary Flathead serves as a source area that contributes to carnivore populations throughout a much larger region. It also occupies a strategic, geographic position along the axis of the Rocky Mountains between the world heritage sites of Glacier, Waterton Lakes and Banff National Parks.

- The entire transboundary Flathead basin appears important for carnivores, but the area from the west side of the Flathead River floodplain eastward to the Continental Divide in both British Columbia and Montana is *especially* vital for carnivores.

There is an east-west asymmetry to the distribution of prey populations and carnivores in the transboundary Flathead basin of both British Columbia and Montana — especially during the critical winter season. The area from the west side of the floodplain of the Flathead River eastward to the Continental Divide is especially important (see various maps).

The Flathead River floodplain is notable for its breadth and richness of plant communities that provide habitats for small mammals and ungulates. Many grizzly bears and other wildlife select the floodplain and other riparian sites during spring, early summer, and fall. The floodplain and meadows, forested benches, and lower mountain slopes on the east side of the river also provide crucial forage and shelter for moose, elk, and white-tailed deer in winter. Wolves and cougars use the eastern side of the valley intensively in winter. Continuing eastward, mid-elevation slopes burned extensively 30-70 years ago provide substantial amounts of huckleberries and buffaloberries that together appear key in sustaining the extraordinarily high density of grizzly bears. Many of the last remaining stands of old-growth Engelmann spruce that provide essential habitat for martens occur on colder sites in the mountains. Continuing eastward toward the Continental Divide, avalanche chutes and lush meadows in subalpine basins provide succulent forbs and grasses for bears and ungulates in summer. Finally, mountain passes along the Divide facilitate movements by both ungulates and carnivores (Fig. 14).

Fig. 14 photo: Ted Smith
View of the upper Flathead River Basin in British Columbia looking towards the Continental Divide.

The extensive floodplain of the Flathead River, the breadth of the valley on the east side of the river, and the rugged topography of the mountains leading up to the Continental Divide all contribute to a rich diversity of habitats that sustains an extraordinarily diverse community of carnivores. South of the international border, this important area is protected within Glacier National Park; north of the border, there is only a small Provincial Park (Akamina-Kishenena). On the Canadian side, the area extending from the road paralleling the west side of the Flathead River floodplain eastward to the Continental Divide and from the border north to about Tombstone Mountain (north of Middlepass Creek) warrants greater protection.

- Watersheds adjacent to the transboundary Flathead such as the Wigwam, Bull, and Elk River in British Columbia and the Castle River in Alberta also provide important habitat and security for carnivores that enhance the value of the Flathead.

These other basins in the regional landscape support notable populations of carnivores. The Elk River area in British Columbia (particularly the western and northern sections) provides important habitat and security for carnivores and likely serves as a crucial link in maintaining connectivity through the Rocky Mountains.

CARNIVORE CONSERVATION

KEY PRINCIPLES AND GUIDELINES FOR CARNIVORE CONSERVATION

A successful conservation strategy for carnivores must allow for their basic mechanisms for resilience to operate at several levels – individual, population, and metapopulation. At the individual level, it must provide sufficient food resources and habitat to support home ranges. At the population level, it must provide enough security to keep mortality rates commensurate with recruitment. At the metapopulation level, it must provide a connected landscape where individuals can disperse successfully to new areas. Finally, the history of carnivore extirpations throughout the world has demonstrated clearly that a policy of antipathy or even benign neglect will not suffice. Managers responsible for carnivores must provide leadership in an arena of powerful economic interests, competing agendas, and multi-jurisdictional complexity.

I believe that the following principles are fundamental for any carnivore conservation strategy to be successful: (1) maintain food resources with management of habitat and prey populations, (2) provide security from excessive mortality with networks of core reserves and other precautionary measures, and (3) maintain regional connectivity with landscape linkages.

Maintain food resources with management of habitat and prey populations

- Maintain the shelter and forage value of mature and old-growth conifers along the Flathead River for ungulates in winter.

Ungulates are a key prey for the larger carnivores. Moose, elk, and white-tailed deer partition their use of the North Fork landscape during the critical winter period on the basis of snow-depth, vegetation, and physiography. Nonetheless, mature and old-growth forests of spruce and Douglas-fir along the Flathead River are crucial habitats for all three species during harsh winters.

- Manage for higher levels of ungulate populations over time by setting conservative quotas for ungulate harvest, especially after harsh winters.

Winter severity, hunter harvest, and predation are key factors influencing the dynamics of ungulate populations – sometimes with lag effects over time. The transboundary Flathead basin has deep snow in winter, an extensive network of roads that facilitates hunter access, and multiple predators … these factors can interact to drive an ungulate population down quickly (Kunkel and Pletscher 1999). In this context, managers should set conservative quotas for ungulate harvest to minimize likelihood of a slide toward lower population levels of prey which, in turn, would result in lower numbers of carnivores. This is especially important in years following harsh winters to enable ungulate populations to rebound.

- Maintain foraging opportunities for bears in riparian sites, avalanche chutes, and burned areas by providing adequate cover and security.

Riparian sites, avalanche chutes, and older burned areas provide key grasses, forbs, and berries for grizzly bears (McLellan and Hovey 1995, 2001). These valuable habitats result mostly from natural disturbances (floods, snow release, and fires) which should be allowed to occur with characteristic variability. Adequate hiding cover should be maintained around these prime feeding sites and/or human access curtailed to provide secure opportunity for foraging.

- Maintain productive habitat of dense, young lodgepole pine and spruce for snowshoe hare and lynx by leaving significant areas un-thinned until later.

Dense stands (>5,000 stems/ha) of lodgepole pine and spruce saplings regenerating after fire or timber harvest provide good habitat for snowshoe hare and lynx (Koehler and Aubry 1994). Conventional thinning of such stands, however, to a few hundred trees per hectare significantly reduces their value (Sullivan and Sullivan 1988, Weaver unpublished data). Tactics of (a) leaving un-thinned patches of various sizes and shapes across the cutting unit, or (b) delaying thinning are being evaluated by researchers.

- Retain remaining stands of old-growth spruce in the commercial forests of the transboundary Flathead as important habitat for martens.

Prime habitat for martens includes mature/old-growth, mesic stands of conifers (particularly spruce-fir) characterized by dense canopy and large-diameter trees, snags, and logs (Buskirk and Ruggerio 1994). In the transboundary Flathead, major wildfires in the 1930s and salvage logging of Engelmann spruce (in response to spruce bark beetle infestations) in the 1950-60s reduced the amount of late-succession forests for marten and other wildlife. Amendment 21 to the Forest Plan of the Flathead National Forest in Montana directs that all remaining old-growth stands be retained. Similar direction should be established for remnant stands of old-growth spruce in the British Columbia portion of the Flathead (Fig. 6).

- Support initiatives by The Nature Conservancy of Montana to secure adequate protection of key private lands along the North Fork Flathead valley in Montana through conservation easements and acquisitions.

Numerous parcels of private land that are important for carnivores occur along the North Fork of the Flathead River in Montana. The Nature Conservancy of Montana (2001) has an active program to secure protection of the most strategic properties.

Provide security from excessive mortality with networks of core reserves and other precautionary measures

Several of these focal carnivore species are vulnerable to excessive mortality because of inherently low reproductive capacity (grizzly bear and wolverine), low productivity and/or survivorship due to comparative scarcity of suitable prey near the margin of their geographic range (lynx), or patchy dispersion of prime habitat (marten). Excessive mortality can arise from over-exploitation (e.g., hunting or trapping quotas) or from incidental killing in chance encounters.

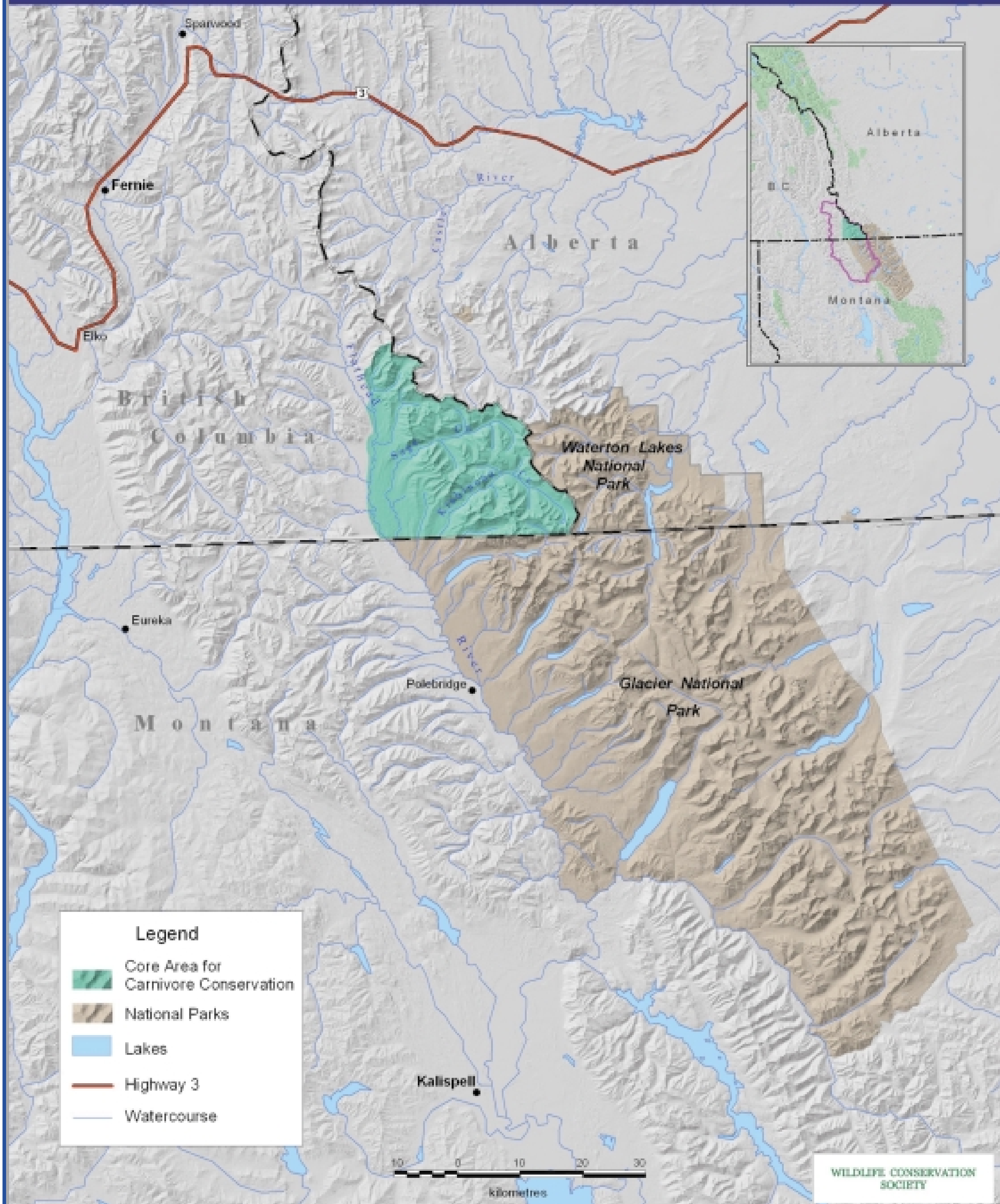
The setting of hunting and trapping seasons and quotas assumes that accurate and precise data on population size and trends is obtained in meaningful timeframes for efficacious responses should declines be detected. Carnivores are notorious, however, for the difficulty and expense of obtaining such data on their populations. Moreover, new technology, new access, or favorable weather conditions can enhance hunting and trapping efficiency and lead to over-exploitation. Incidental killing is a function of (a) how often humans encounter a carnivore, and (b) whether they will shoot it if they can. This depends upon human attitudes and behaviors that may not be charitable toward carnivores. The bottom line is that most carnivores lack resiliency and thus are vulnerable to excessive mortality that may not be easily detected nor reduced … hence there is uncertainty and risk.

One common strategy for minimizing exposure to risk is to place valuable resources into safe havens or refugia. Indeed, the powerful role of refugia in promoting persistence of populations has emerged as one of the most robust concepts of modern ecology (Fahrig 1988). Wildlife scientists throughout the world are recognizing that carnivores need some network of core reserves where security from human impacts takes precedence, and ecological integrity is restored or maintained with natural processes (Weaver et al. 1996, Noss et al. 1999). Core reserves can benefit many wildlife in several ways by: (1) allowing undisturbed access to important habitats where energetic needs can be fulfilled, (2) minimizing potential for illegal or incidental killing by humans, and (3) retaining wary behavior rather than habituation to humans.

- <u>Provide a permanent, year-round core reserve for carnivores in the upper Flathead River in British Columbia.</u>

At present, much of the Flathead River basin in British Columbia is accessible with roads. With its extraordinary richness of carnivore species and strategic geographic position, the transboundary Flathead warrants a higher level of protection. A core reserve in the upper Flathead River in British Columbia would improve security in that jurisdiction for several species of carnivores and contribute significantly to vital protection provided by Waterton Lakes National Park in Alberta and Glacier National Park in Montana. This core reserve should extend from the road paralleling the west side of the Flathead River eastward to the Continental Divide and from the international border north to about Tombstone Mountain (north of Middlepass Creek) (Fig. 15).

Core Reserve for Carnivore Conservation in the Upper Flathead, British Columbia



- Provide a network of seasonal or permanent security zones throughout the transboundary Flathead basin and elsewhere in the new 'Southern Rocky Mountain Conservation Area'.

Contemporary management of grizzly bears focuses on the concept of security areas (defined as areas with no motorized access that are at least 0.5 km from an *open* road and greater than about 10 km^2 in size). Recent studies of adult female grizzly bears indicate that, on average, about 68% of their home range exists in secure status (Mace and Waller 1997, Gibeau et al. In Press). This security level has been applied to discrete landscape units called Bear Management Units (BMUs) that are scaled to the average size of adult female home range. One weakness of the approach is that it does not explicitly account for habitat quality; conceivably, a designated security area could have some areas of poor bear habitat and the better habitat could be in a roaded area (McLellan et al. 2000). An alternative has been proposed to secure (with closed gates on roads) the best 45% of habitat in a management unit for a particular *season*. Uncertainties include whether the gates will be effectively closed and how bears will respond to areas that are open and closed on a seasonal basis.

The level of security may vary with the needs of the least resilient species, importance of the area, seasonal patterns of landscape use by carnivores, and the risk of adverse consequences. Greater, year-round security should be provided in areas where carnivore population density and habitat suitability is high and carnivore use occurs throughout several seasons due to temporal and spatial dispersion of key foods. Smaller security zones with seasonal access might serve in areas where scientific studies indicate that carnivore use is strongly seasonal, seasonal closures can be effectively and consistently implemented, and core reserves are interspersed in the surrounding regional landscape. In either case, consideration of key habitats for one or more focal species should guide the strategic identification and delineation of security zones.

Maintain regional connectivity with landscape linkages

Concern is emerging that future developments and roads expansion along Highway 3 running east-west across the Continental Divide in southwestern Alberta and southeast British Columbia could affect the movement of carnivores between important habitats in this region. Permanent human developments and roads can fragment landscapes used by wide-ranging carnivores, leading eventually to smaller, more isolated populations that become vulnerable to regional extirpation (Weaver et al. 1996, Noss et al. 1996).

- Identify and secure protection of key linkages for carnivores along Highway 3.

  Apps (1997) used the 'linkage-zone' model developed by Servheen and Sandstrom (1993) for grizzly bears to identify likely fracture and linkage zones across Highway 3. This model scores four attributes of a landscape for grizzly bears: disturbance from human development, disturbance from roads and trails, value of hiding cover, and the value of riparian habitats. For this report, I overlaid the linkage/ fracture maps developed by Apps (1997) with maps of high grizzly bear capability depicted by the B.C. Ministry of Environment, Lands, and Parks.

  Fragmentation along Highway 3 in this area is due largely to the communities of Fernie, Hosmer, Sparwood, and Crowsnest Pass (Fig. 16) (Apps 1997). Three possible linkages span the highway corridor. Perhaps the best one occurs between Elko and Fernie: it connects the headwaters of the Flathead and Morrissey Creek east-southeast of the highway to the Lizard Range and Lizard Creek valley to the west-northwest (Fig. 17). This area provides high quality habitat for grizzly bears (B. McLellan, pers. comm.). The second potential linkage occurs between Hosmer and Sparwood: it, too, connects several ridges just north of the headwaters of the Flathead to the important west side of the Elk Valley via Lladner and McCool Creeks. If human developments have already filtered movements of female grizzly bears across Highway 3 (Proctor et al. 2001), then multiple linkages may be necessary to promote breeding opportunities by multiple male bears on both sides of the highway.

Fig. 16

GRIZZLY BEAR LINKAGE AND FRACTURE ZONES ALONG HIGHWAY 3, B.C AND ALBERTA

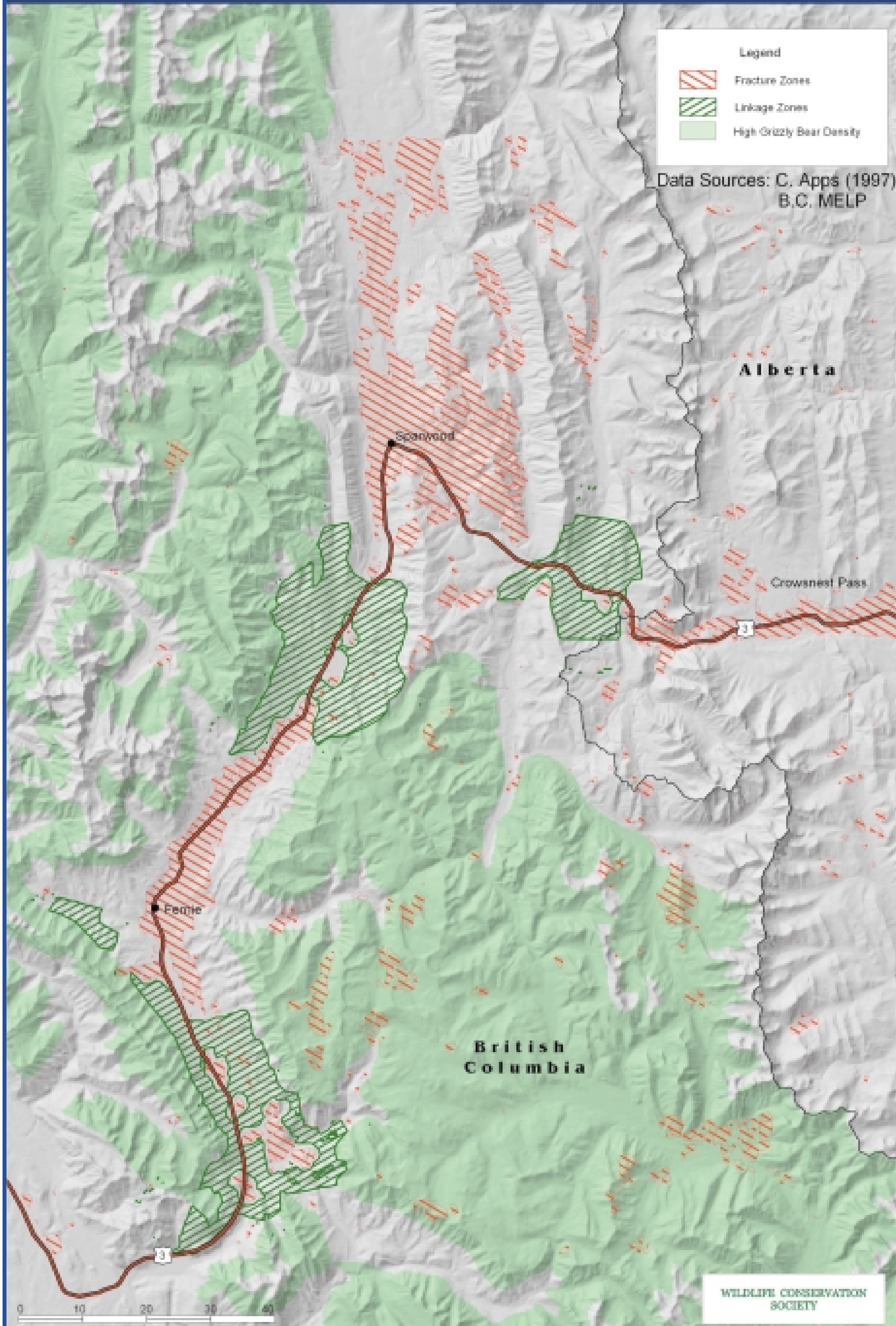
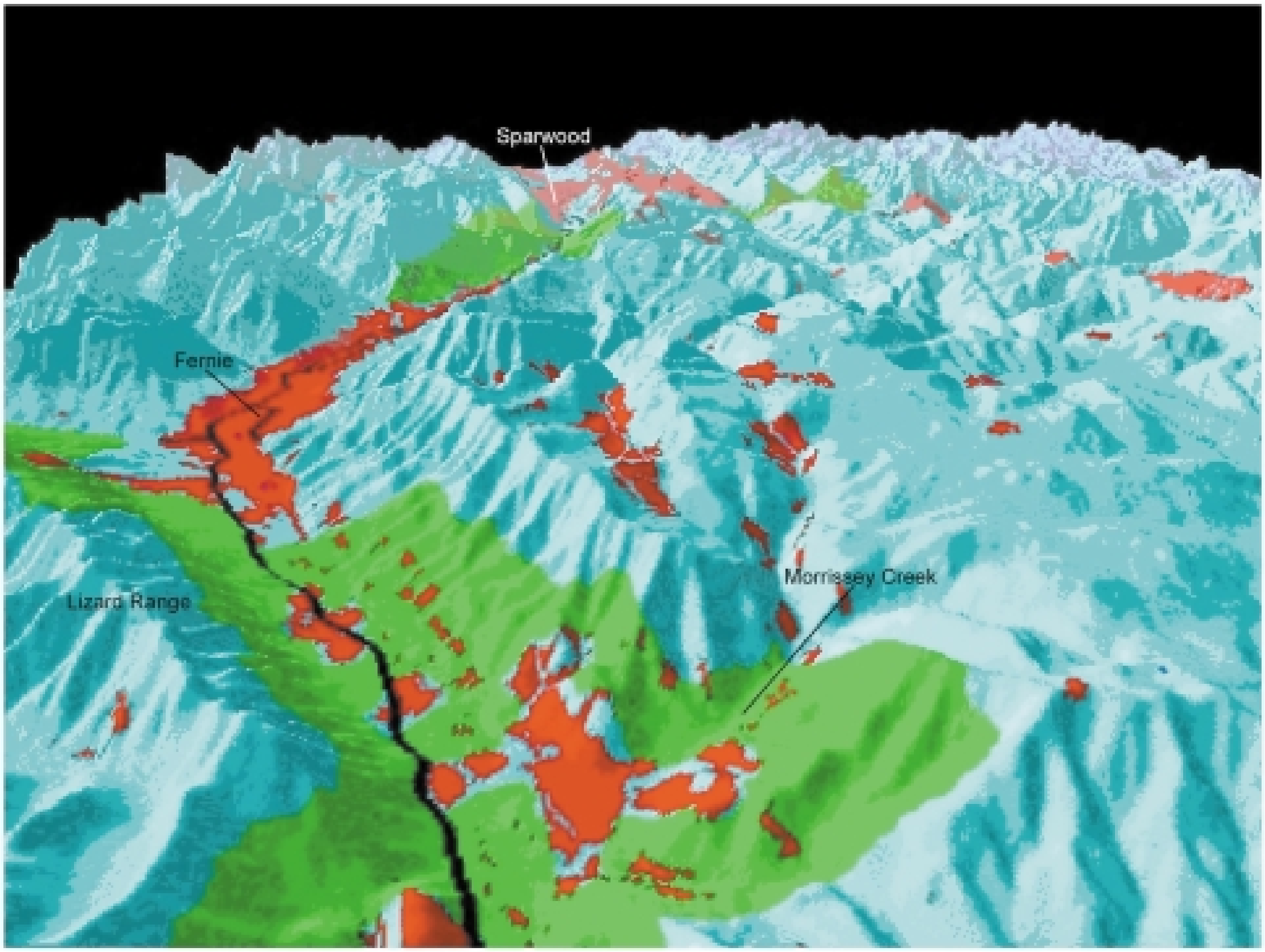


Fig. 17

LINKAGE AND FRACTURE ZONES ALONG HIGHWAY 3



S.W. to N.E. view of the westernmost linkage, highway 3 corridor

Data Source: C. Apps (1997)

Coda for Carnivore Conservation

Carnivores are prone to extirpation. At the apex of food pyramids, they require large areas to obtain preferred foods or vulnerable prey; as a consequence, carnivores typically occur at low densities. Several species of carnivores have fairly low reproductive rates and are vulnerable to excessive rates of mortality. Several of the carnivores are capable of long-distance dispersal but may be thwarted by major highways and human settlements; others (especially young females) may not move very far in seeking their own home range. Hence, most of the carnivore species have low to medium levels of resiliency to human impacts on their habitat and/or populations (Weaver et al. 1996).

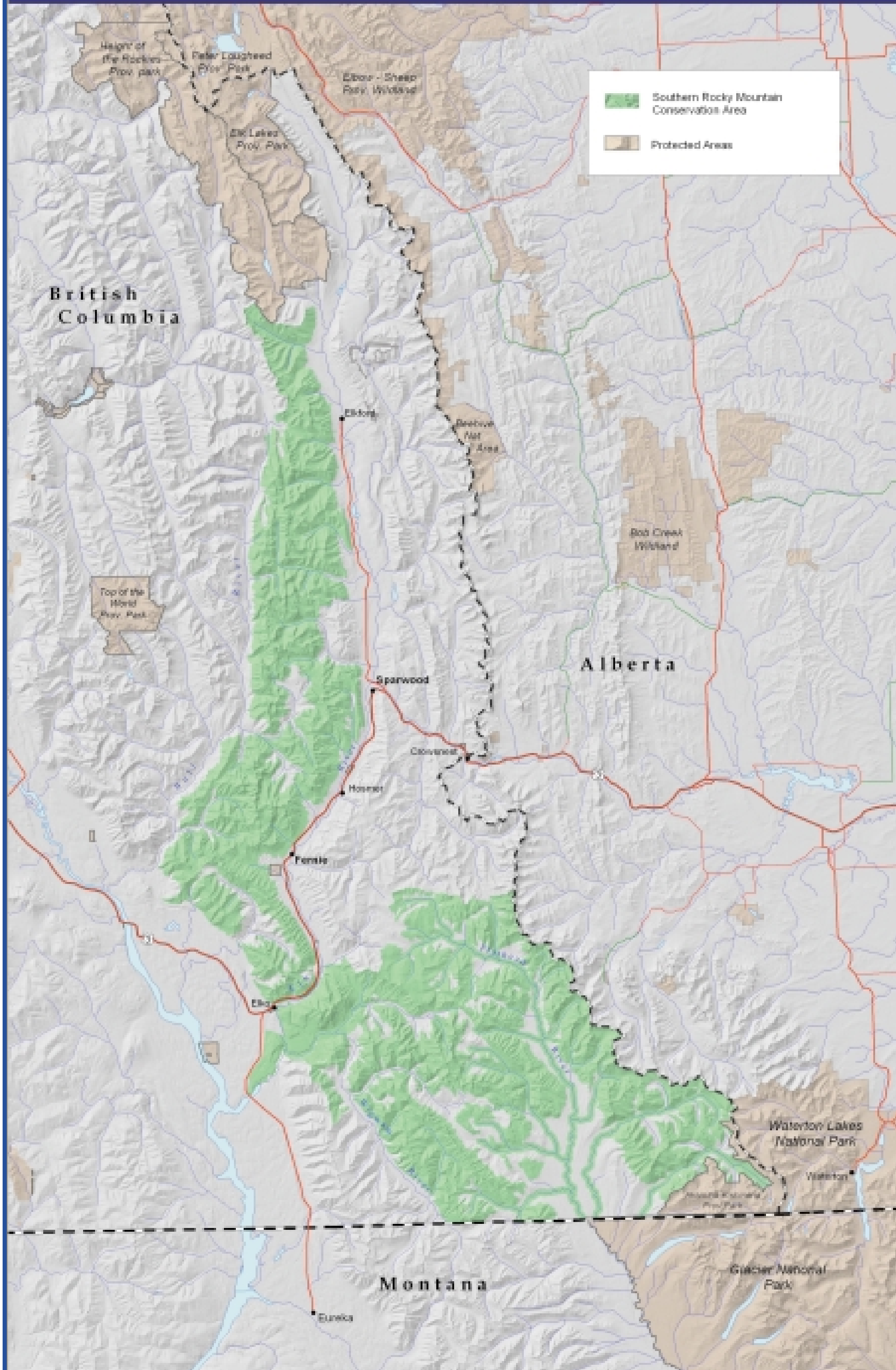
Following the arrival of Europeans, distribution and abundance of large carnivores decreased dramatically in the wake of spreading human enterprises. With technological innovations, *Homo sapiens* accelerated the rate and expanded the scope of impacts. Systematic loss of habitat and excessive killing caused reductions in population size, distribution, and connectivity that resulted in regional extirpations. Viable populations of grizzly bears survived in the United States only in the larger sanctuaries of Glacier and Yellowstone National Parks and adjacent wildernesses. At present, several of the carnivore species covered in this assessment are listed under the U.S. Endangered Species Act. In the final analysis, space is essential for these wide-ranging carnivores … and wild spaces are becoming ever more endangered in the modern world (Hummel and Pettigrew 1991).

The Rocky Mountains from Yellowstone to the Yukon offer one of the last, best opportunities on the continent to conserve carnivores (Locke 1997). Renowned throughout the world for their spectacular scenery and natural features, the Rockies have provided a claw-hold (albeit tenuous at times) for a rich assemblage of carnivores. In the midst of international acclaim over the past century for the National Parks of Banff, Waterton Lakes, and Glacier, however, the area *between* them has been overlooked by all but a few.

William Hornaday, a pioneering conservationist and first director of the New York Zoological Society (later re-named the Wildlife Conservation Society), visited this area in 1905 and gave a prescient recognition of its importance to wildlife: “Whoever aids in preserving from extinction the grand game of British Columbia renders good service to two countries.” In April, 2001, the government of British Columbia designated nearly 2800 sq. km. in this region – including much but not all of the Flathead – as the ‘Southern Rocky Mountain Conservation Area’ (Fig. 18). The primary objective is to maintain wildlife and habitat values while allowing for sustainable development of resources (e.g., logging, mining). Although this new policy represents a step in the right direction, the next challenge is to develop and implement a conservation plan that honors these world-class wildlife values. This will require leaders in resource conservation who resolve complex problems at regional scales by effectively engaging the public and working with inter-jurisdictional teams.

It is in this context of biological vulnerability, vanishing spaces, and beckoning opportunity that the transboundary Flathead assumes critical importance for carnivores as a crucible for our commitment to conservation.

Southern Rocky Mountain Conservation Area



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