

Rodents of Northwestern North America

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Habitat diversity of the Northwest

The Northwestern North American Region as defined by the IUCN/SSC Rodent Specialist Group includes Greenland; Yukon Territory, the Northwest Territories (MacKenzie, Keewatin, Franklin Districts), British Columbia, Alberta, Saskatchewan, and Manitoba in Canada; and the states of Alaska, Washington, Oregon, Idaho, Montana, Wyoming, North Dakota, South Dakota, and Nebraska in the United States (Fig. 2.1). This region of over 12 million km² includes the northern Great Plains, Black Hills, northern Rocky Mountains, northern Great Basin, Cascade Mountains, coast ranges, Northwest Coast archipelagos, Aleutian Islands, Alaska Range, Yukon Basin, Brooks Range, Arctic Coast, the Canadian Shield, the Hudson Bay Lowlands of western Hudson Bay, the low and high arctic island archipelagos, and Greenland. The corresponding range of habitats includes short-grass and tall-grass prairie, shrub-steppe desert, several kinds of coniferous forests, and Arctic and alpine tundras. The region spans some 40° of latitude and 140° of longitude (Alaska alone crosses 30° of

latitude and 42° of longitude). Consistent with the considerable topographic variation, this vast region contains diverse climates and faunal influences.

Vegetational diversity is limited in the high arctic, but diversity of species and habitats generally increases toward the south throughout the region. Alaska is divided into four major floral areas: the coniferous forest of southeast and south central Alaska; the boreal forest of interior Alaska; the tundra of the Arctic slope; and the treeless vegetation of the shores of the Bering Sea, Aleutian Islands, Alaska Peninsula, and part of Kodiak Island (Hultén, 1968). Further south, British Columbia has 13 biotic provinces (Cowan and Guiguet 1965), and Oregon and Washington together have 15 (Franklin and Dyrness 1988).

Species diversity is highest along the western coast (British Columbia, Washington, and Oregon) and declines inland (Pojar 1993). This is due to prevailing westerlies, which bring heavy precipitation to the coast and to western slopes of interior mountain ranges, supporting temperate coniferous forests. Precipitation decreases on eastern slopes of the coast ranges, and



Figure 2.1. Northwestern North America Rodent Specialist Group Region, which includes Greenland, western provinces of Canada, and northwestern states of the United States.

especially in the interior valleys of British Columbia and east of the Cascade Mountains. Northern Great Basin desert occurs at lower elevations in the Columbia Basin of eastern Washington, east of the Cascades in eastern Oregon, and in southern Idaho and southwestern Wyoming. Parts of British Columbia and Alberta, central and northern Idaho, western Montana, and western Wyoming are dominated by coniferous forests and, at higher elevations, alpine tundras of the Rocky Mountains. To the east (in the remainder of Alberta, Montana, and Wyoming, east through Saskatchewan, Manitoba, the Dakotas, and Nebraska), stretch the Great Plains, broken only by isolated mountains and hills, such as the Black Hills of South Dakota. The Great Plains were originally grasslands with trees along river courses but have been largely converted to agriculture. To the north, the Canadian Shield is covered by vast tracts of taiga (northern boreal forest). In the Mackenzie River drainage of Yukon Territory and western Northwest Territories, tree line extends to nearly 68°N; further east, maritime effects from Hudson Bay limit the tree line to about 55°N.

In the West, the chaotic array of high mountains (many of which are actively orogenic), river valleys and intermontane basins, fiords, and near-shore islands promotes a complex mixture of temperature and moisture regimes. The rugged topography and rivers act as barriers to movement by rodents; as a result, many taxa have small geographic ranges. For example, the Snake River in southern Idaho is a major barrier for rodents where it is more than 200m wide (Davis 1939). East of the Rocky Mountains and in the northern reaches of the continent, the landscapes, habitats, and fauna become more uniform and continuous. Rodent diversity decreases to the north and east across the more or less homogeneous Canadian Shield. Hudson Bay and the many straits that separate the arctic islands and Greenland are major barriers to rodent dispersal. Although ice-covered much of the year, these water barriers nevertheless act as filters for faunal interchange. For example, McClure Strait, Viscount Melville, and Lancaster Sounds together form a significant dispersal barrier that isolates the high arctic islands (Queen Elizabeth Islands) from the low arctic archipelago (Banks, Victoria, and Baffin islands). In the extreme north, Greenland and the high arctic islands of Canada have only a single rodent species, the Greenland collared lemming (*Dicrostonyx groenlandicus*).

Although topographic and climatic parameters explain much of the rodent diversity of the region, the Pleistocene glacial periods also have had an influence. As recently as 10,000 years ago, most of Canada and much of the northern third of the contiguous United States were buried under ice as much as 3500m thick (Porter 1983). The Rocky Mountains, Intermountain West, and Pacific Coast had mountain glaciers and cooler climates than at present. Some areas must have

been inhospitable for rodent species. Whole floras and faunas were either displaced south of the ice sheets and glaciated mountains, or persisted in refugia such as that in northwestern Alaska and northern Yukon Territory, where they came in contact with Old World floras and faunas across the emergent Bering land bridge (Beringia). The possibility that other refugia also existed, particularly along the northwestern coast of Alaska, may explain the high level of endemism in that area (Heusser 1989, MacDonald and Cook 1996). In the high arctic, the Pearyland refugia in northern Greenland and possibly Ellesmere Island may have contributed to speciation in *Dicrostonyx* (MacPherson 1965).

With the return of warmer climates, ice sheets retreated northward and to higher elevations. The displaced plants and animals, as well as immigrants from the Old World, colonized newly exposed land areas, spreading rapidly over continuous areas. Thus, large, continuous areas of the central plains are characterized by a uniform flora and fauna, and by species that are relatively undifferentiated over vast expanses. Recolonization proceeded more slowly through the rugged topography of western regions, and left gaps and barriers that promoted isolation of small populations and high genetic diversity.

The distribution of flora and fauna in glaciated mountainous regions reflects probable dispersal routes into the region along either montane corridors or river valleys. During glacial maxima, boreal species survived in refugia, were forced south by glaciation and climatic change, and may have lived on exposed continental shelves of the Pacific Coast. With the return of warmer conditions, some populations of these became isolated on off-shore islands. Return of warmer conditions also isolated populations of many northern species at higher elevations on southern mountain ranges.

Apparently rodents were minimally affected by the Pleistocene extinctions that eliminated many of the larger species at the end of the last glaciation. For example, fossil remains of rodents from caves and archeological sites in the Great Basin and the Columbia Basin indicate that extant rodent species were present up to 20,000 years ago (Lyman and Livingston 1983, Henry 1984, Grayson 1987). Despite the climatic changes during the past 12,000 years (Davis 1984, Davis *et al.* 1986), scientists are not aware of extinctions of rodent species, although their abundance at different locations (and presumably their geographic distributions) has changed (Henry 1984, Grayson 1987). The present rodent fauna has thus had a long period of adaptation to the Northwestern Region.

The fauna is typical of the Nearctic realm, although Alaska and the Yukon Territory lie at the crossroads between two continents and the Holarctic character of the region's fauna and flora reflect extensive interchange with Asia. The region has a strong boreal element,

augmented by many southwestern and eastern species that reach their distributional limits within the region.

Diversity of Northwestern rodents

The Northwestern Region includes over half (109 of 206; 52.9%, Table 1.1) of the rodent species found in North America north of Mexico (Wilson and Reeder 1993) and over a third (494 of 1370, 36%) of the subspecies (Hall 1981), making it intermediate in diversity between the Southwestern and Eastern Regions. Three groups of rodents that are common in grasslands of northern latitudes in both the Old and New Worlds characterize the Northwestern Region: ground squirrels (*Spermophilus* spp.), marmots (*Marmota* spp.), and arvicoline mice such as voles (*Microtus* spp.) and lemmings (*Dicrostonyx* spp.). Of the rodents found in North America north of Mexico, the following are found within the Northwestern Region:

- all six species of marmots (*Marmota*);
- 18 of 21 species of ground squirrels (*Spermophilus*);
- 34 of 42 species of arvicoline mice;
- 8 of 9 pocket gophers of the genus *Thomomys*;
- all four North American species of jumping mice (family Dipodidae);
- only 10 of 37 species of desert rodents of the family Heteromyidae (pocket mice, kangaroo mice, and kangaroo rats); and
- only 14 of 43 species of sigmodontine murids (typical rats and mice).

Thirty species of rodents (including at least 50 subspecies) are endemic to the Northwestern Region: 15 species of arvicoline mice, eight ground squirrels (*Spermophilus*), three marmots (*Marmota*), two deer mice (*Peromyscus*), a chipmunk (*Tamias*), and a pocket gopher (*Thomomys*). Many more species are not endemic but have their centers of distribution in the Northwestern Region. Their ranges extend south into forested habitats along western mountain ranges. In addition, 13 species are found along the Pacific Coast in Oregon and California, and have ranges that extend inland to the Cascade-Sierra Nevada mountain chain, north into southwestern British Columbia, or south into Baja California.

The rodent fauna of Northwestern North America is the least-studied on the continent. This is especially true for Alaska. In most cases, subspecific taxonomy was based only on a small number of specimens and is outdated. Often, taxonomic decisions were based exclusively on size and pelage coloration, characters that are known to be highly variable and unreliable in some genera (e.g., pocket gophers, *Thomomys*; Smith and Patton 1980). Most of the taxa in the Northwestern Region are in need of careful taxonomic re-evaluation in studies that include larger sample sizes and utilize cranial morphometrics, bacula,

karyotypes, and molecular genetic techniques. Many of the rodent taxa found in Alaska have not been included in recent taxonomic revisions, and are especially in need of study.

Major threats in the Northwestern Region

Much of the vast Northwestern Region supports a fauna that has been relatively unperturbed by humans. However, major threats to rodents in the region are direct results of human-induced habitat loss, particularly large-scale habitat manipulation. Chief among these are: 1) conversion of native habitat to agricultural land, particularly in the Columbia Basin of eastern Washington and adjacent Oregon; 2) expansion of urban centers usurping critical habitat of restricted endemic subspecies; 3) the effects of habitat manipulation and introduction of exotic species on island endemics; 4) fire suppression in coniferous forests, gradually eliminating species dependent upon the herbaceous understory of the forest; 5) logging of old growth forest, endangering species dependent on large, old trees; and 6) grazing of domestic livestock in riparian areas. Control campaigns using rodenticides have adversely affected two taxa.

Agricultural development in the Great Plains and intermontane valleys and logging (particularly of forests in southeastern Alaska) have had negative impacts on a number of taxa. Additionally, the extensive maritime region of Alaska and British Columbia includes numerous islands with isolated biotas. Many rodent taxa in this region are island endemics; their restricted distributions may make them particularly sensitive to disturbance. The effects of oil and gas exploration on rodent populations in arctic ecosystems need to be evaluated.

Rodents of conservation concern in the Northwestern Region

In the Northwestern Region, there has been little conservation action to date for rodents. One species, the Vancouver marmot (*Marmota vancouverensis*), is federally listed as endangered in Canada and the United States; one subspecies (a southern bog lemming, *Synaptomys cooperi relictus*, of Nebraska) is listed as C3A (extinct) by the U.S. Fish and Wildlife Service; and 13 taxa are, or have been, candidates for listing under the U.S. Endangered Species Act. The states and provinces list 52 rodents as of conservation concern. Often taxa on the U.S. federal list are not on state lists, and vice versa; indeed, the two sets of lists share only 10 taxa.

Of the four Canadian provinces and two territories in the region, only British Columbia and Alberta have

Table 2.1. Rodents of conservation concern in the Northwestern Region.

Species that are widespread and secure throughout most of their range, but have subspecies of conservation concern in this region, are considered to be of Lower Risk and least concern, and are listed as LR(lc). IUCN Red List Category codes are defined in Appendix 2.

	Historical distribution	Red List Category	Species account (p.)
APLODONTIDAE			
<i>Aplodontia rufa</i>	USA: CA,NV,OR,WA Canada: BC	LR(nt)	30
SCIURIDAE			
<i>Cynomys ludovicianus</i>	USA, Canada, Mexico	LR(nt)	35
<i>Glaucomys sabrinus</i>	USA, Canada	LR(lc)	37
<i>G. s. griseifrons</i>	USA: AK	EN:A1c;A2c;B1;B2c	
<i>Marmota caligata</i>	USA, Canada	LR(lc)	39
<i>M. c. sheldoni</i>	USA: AK	DD	
<i>M. c. vigilis</i>	USA: AK	DD	
<i>Marmota vancouverensis</i>	Canada: BC	EN:C2b;D	40
<i>Spermophilus brunneus</i>	USA: ID	EN:B2d;B3d	43
<i>S. b. brunneus</i>	USA: ID	CR:B1;B2d	
<i>S. b. endemicus</i>	USA: ID	VU:B1;B3d	
<i>Spermophilus elegans</i>	USA	LR(lc)	45
<i>S. e. nevadensis</i>	USA: ID,NV,OR	DD	
<i>Spermophilus lateralis</i>	USA, Canada	LR(lc)	46
<i>S. l. wortmanni</i>	USA: CO,WY	DD	
<i>Spermophilus parryi</i>	USA, Canada	LR(lc)	49
<i>S. p. kodiacensis</i>	USA: AK	DD	
<i>S. p. lyratus</i>	USA: AK	DD	
<i>S. p. nebulicola</i>	USA: AK	DD	
<i>Spermophilus townsendii</i>	USA: WA	DD	51
<i>Spermophilus tridecemlineatus</i>	USA, Canada	LR(lc)	51
<i>S. t. alleni</i>	USA: WY	DD	
<i>Spermophilus washingtoni</i>	USA: OR,WA	VU:A1a;B1;B2d;C2a	52
<i>Tamias minimus</i>	USA, Canada	LR(lc)	54
<i>T. m. selkirkii</i>	Canada: BC	VU:D2	
CASTORIDAE			
<i>Castor canadensis</i>	USA, Canada, Mexico	LR(lc)	59
<i>C. c. phaeus</i>	USA: AK	DD	
GEOMYIDAE			
<i>Thomomys idahoensis</i>	USA: ID,MT,UT,WY	LR(nt)	63
<i>T. i. confinus</i>	USA: MT	LR(nt)	
<i>Thomomys mazama</i>	USA: CA,OR,WA	LR(nt)	63
<i>T. m. couchi</i>	USA: WA	VU:B1;B2c	
<i>T. m. glacialis</i>	USA: WA	VU:B1;B2c	
<i>T. m. helleri</i>	USA: OR	LR(nt)	
<i>T. m. louiei</i>	USA: WA	CR:A1c;C2b	
<i>T. m. melanops</i>	USA: WA	LR(nt)	
<i>T. m. pugetensis</i>	USA: WA	VU:B1;B2c	
<i>T. m. tacomensis</i>	USA: WA	EX	
<i>T. m. tumuli</i>	USA: WA	VU:B1;B2c	
<i>T. m. yelmensis</i>	USA: WA	VU:B1;B2c	
<i>Thomomys talpoides</i>	USA, Canada	LR(lc)	66
<i>T. t. douglasi</i>	USA: WA	VU:B1;B2c	
<i>T. t. limosus</i>	USA: WA	LR(nt)	
<i>T. t. segregatus</i>	Canada: BC	LR(nt)	
HETEROMYIDAE			
<i>Microdipodops megacephalus</i>	USA: CA,ID,NV,OR,UT	LR(lc)	79
<i>M. m. atrelictus</i>	USA: ID	VU:D2	
MURIDAE			
<i>Arborimus albipes</i>	USA: CA,OR	DD	86
<i>Clethrionomys gapperi</i>	USA, Canada	LR(lc)	87
<i>C. g. solus</i>	USA: AK	DD	
<i>Dicrostonyx exsul</i>	USA: AK	DD	87
<i>Dicrostonyx nunatakensis</i>	Canada: YT	DD	88
<i>Dicrostonyx unalascentis</i>	USA: AK	DD	89
<i>D. u. stevensoni</i>	USA: AK	DD	
<i>D. u. unalascentis</i>	USA: AK	DD	
<i>Microtus abbreviatus</i>	USA: AK	DD	89
<i>M. a. abbreviatus</i>	USA: AK	DD	
<i>M. a. fisheri</i>	USA: AK	DD	

Table 2.1 ... continued			
	Historical distribution	Red List Category	Species account (p.)
<i>Microtus longicaudus</i>	USA, Canada	LR(lc)	93
<i>M. l. coronarius</i>	USA: AK	DD	
<i>Microtus montanus</i>	USA, Canada	LR(lc)	96
<i>M. m. codiensis</i>	USA: MT,WY	DD	
<i>M. m. zygomaticus</i>	USA: WY	DD	
<i>Microtus oeconomus</i>	USA, Canada	LR(lc)	97
<i>M. o. amakensis</i>	USA: AK	DD	
<i>M. o. elymocetes</i>	USA: AK	DD	
<i>M. o. innuitus</i>	USA: AK	DD	
<i>M. o. popofensis</i>	USA: AK	DD	
<i>M. o. punukensis</i>	USA: AK	DD	
<i>M. o. sitkensis</i>	USA: AK	DD	
<i>Microtus pennsylvanicus</i>	USA, Canada	LR(lc)	99
<i>M. p. admiraltiae</i>	USA: AK	LR(nt)	
<i>M. p. kincaidi</i>	USA: WA	LR(nt)	
<i>Microtus townsendii</i>	USA: CA,OR,WA	LR(nt)	101
	Canada: BC		
<i>M. t. cowani</i>	Canada: BC	LR(cd)	
<i>M. t. pugeti</i>	USA: WA	LR(nt)	
<i>Neotoma floridana</i>	USA	LR(lc)	102
<i>N. f. baileyi</i>	NE	LR(nt)	
<i>Onychomys leucogaster</i>	USA, Canada, Mexico	LR(lc)	106
<i>O. l. durranti</i>	USA: OR,WA	DD	
<i>Synaptomys borealis</i>	USA, Canada	LR(lc)	119
<i>S. b. artemisiae</i>	USA: WA	LR(nt)	
	Canada: BC		
<i>Synaptomys cooperi</i>	USA, Canada	LR(lc)	120
<i>S. c. relictus</i>	USA: NE	EX	
DIPODIDAE			
<i>Zapus hudsonius</i>	USA, Canada	LR(lc)	120
<i>Z. h. campestris</i>	USA: MT,SD,WY	VU:B1;B2c	
<i>Z. h. preblei</i>	USA: CO,WY	EN:B1;B2c	
<i>Zapus trinotatus</i>	USA: CA,OR,WA	LR(nt)	123
	Canada: BC		

prepared lists of rodents at risk. Canada has no federal endangered species legislation, and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) supplies that function. Status reports and national designations have been completed by COSEWIC for only nine of the rodent species found in the region (1 endangered, 5 vulnerable, 3 not at risk).

The Vancouver marmot (*Marmota vancouverensis*) and northern Idaho ground squirrel (*Spermophilus brunneus brunneus*) are the only species with existing conservation action plans. We know of no action being undertaken in the field for the conservation of any other Northwestern rodent. Thus, much remains to be accomplished in rodent conservation in Northwestern North America; the rodents of conservation concern identified by this Action Plan represents a starting point (Tables 2.1, 2.2). However, enlisting support for less charismatic species such as pocket gophers and ground squirrels will be difficult because these have been long regarded as vermin. Future conservation action for rodents may be further impeded by the bitter controversy over spotted owls and logging of old-growth forests. This debate has generated negative feelings in the region toward the conservation of endangered species.

Table 2.2. Rodent taxa of concern in the North-western Region.

"Species of concern" here include only those that are of concern at the global level, and do not include those that are LR(lc). Numbers of taxa listed at the species level are indicated in boldface. Families are listed in order of their contribution to the North American rodent fauna.

Family	Total species	IUCN Red List Category						
	(n)	EX	CR	EN	VU	LR(cd)	LR(nt)	DD
Muridae	45	1				1	5	15
Sciuridae	41		1	2	1		1	1
				1	2			8
Heteromyidae	10				1			
Geomyidae	7	1	1		6		2	5
Dipodidae	3			1	1		1	
Castoridae	1							1
Erethizontidae	1							
Aplodontidae	1						1	
Totals	109	2	2	2	10	1	6	6
							10	24