2.0 SPECIES INFORMATION

LISTING STATUS

The Canada lynx was proposed for listing as threatened under the Endangered Species Act on 8 July 1998 (Federal Register Volume 63, No. 130). On March 24, 2000, the final rule listing the contiguous United States Distinct Population Segment (DPS) was issued (Federal Register Volume 65, No. 58). The main factor threatening the DPS of lynx in the contiguous U.S. is the inadequacy of existing regulatory mechanisms. To address this inadequacy, the LCAS (Ruediger et al. 2000) was developed to provide a consistent and effective approach to conserve Canada lynx on federal lands in the conterminous U.S. The document was initiated by USFS, BLM, and U.S. Fish and Wildlife Service (USFWS). Because of the guidance set forth in the LCAS, there are now clear objectives, standards, and guidelines to follow in the delineation, mapping, and management of lynx and their habitats. The status of lynx in Wyoming is as a furbearer with no harvest allowed. It is a protected nongame species.

DESCRIPTION

The lynx is a medium-sized, short-bodied cat with long legs and an overall stocky build (Clark and Stromberg 1987). Paws are large and well-furred, ears tufted, tail blunt and short, and the head has a flared facial ruff. Winter coloring is typically grizzled brownish-gray mixed with buff or pale brown on the top and grayish-white or buff-white on the underside (Koehler and Aubry 1994). In summer, the pelage is more reddish to gray-brown. The tail is black-tipped all the way around. Total length is 67-85 cm and weight 8-10.5 kg; males are slightly larger than females (Clark and Stromberg 1987, Koehler and Aubry 1994). The lynx differs from the bobcat in having paws that have twice the surface area (Quinn and Parker 1987), enabling them to forage in deep snow; a black-tipped tail whereas the bobcat's tail is black only on the top surface; a less spotted coat; and a tail shorter than one-half the length of the hind foot (Tumlison 1987).

HABITAT USE

Cool, moist coniferous forests with cold, snowy winters and abundant snowshoe hares define the required habitat of lynx. Primary vegetation in lynx habitat is lodgepole pine, subalpine fir, and Engelmann spruce (Aubry et al. 2000). Secondary habitat includes cool, moist Douglas-fir, grand fir, western larch, and aspen forests. Dry forests such as ponderosa pine and climax lodgepole pine do not provide habitat for lynx (Ruediger et al. 2000). In the western U.S., 70% of lynx occurrences were at elevations of 1,500 – 2,000 m (4,920 – 6,560 ft.), but in Wyoming the elevational range for all lynx occurrences was 1,500 – 3,500 m (4,920 – 11,480 ft.) (McKelvey et al. 2000b).

Snow conditions in northern boreal forests are consistent, cold, and dry; in contrast, southern boreal forests have snow depths that are more variable and may be subjected to more freezing and thawing, causing crusting on the snow which may reduce the competitive advantage that lynx have in soft snow with their long legs and low foot loadings (Buskirk et al., 2000a; 2000b).

Lynx require a complex mosaic within their home range to meet the different habitat needs. They prey on snowshoe hares in areas with high stem density and dense shrubby and coniferous growth with stems and branches that protrude above the snow, and they den in areas with large woody debris in the form of down logs or root wads (Koehler 1990, Ruediger et al. 2000, Squires and Laurion 2000). Older and mixed-age forests with a patchwork of well-developed shrubs and young trees provide the dense understory and

large downed logs required for both foraging and denning habitats. These forest types provide snowshoe hare habitat over a longer period of time and also support red squirrel populations (Buskirk et al. 2000b).

Diet

The primary prey is the snowshoe hare (*Lepus americanus*). In studies from Canada, Alaska, and Washington State, snowshoe hares comprised 35-97% of the diet (Koehler and Aubry 1994). Alternate prey includes red squirrels (*Tamiasciurus hudsonicus*) and other squirrels (*Spermophilus* sp.), porcupine (*Erethizon dorsatum*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), mice and voles (*Peromyscus* spp. and *Microtus* spp.), shrews (*Sorex* spp.), fish, and deer (*Odocoileus* sp.) and moose (*Alces alces*), mostly as carrion (Ruediger et al. 2000, Tumlison 1987). In Washington, the only state in the contiguous U.S. for which data are available, the annual diet was 79% hares, 24% tree squirrels, 3% ungulates, and 3% grouse (Koehler 1990). In northern populations red squirrels, voles, and other small mammals are a larger component of summer and fall diets compared with the winter diet focus on snowshoe hares (Anderson and Lovallo 2003).

Lynx populations in southern portions of the range must take other prey to a greater degree than in northern populations, due to the lower density of snowshoe hares (Hodges 2000). In southern boreal forests, red squirrels are especially important in the diet, as they are in northern boreal forests during low hare population cycles (Aubry et al. 2000). Lynx also use alternative prey to a greater degree in summer than in winter in both northern and southern boreal forests, although data are scarce (Aubry et al. 2000). In areas with patchy lynx habitat, lynx are more opportunistic and may feed occasionally on white-tailed jackrabbits (*Lepus townsendii*), black-tailed jackrabbits (*Lepus californicus*), sage grouse (*Centrocercus urophasianus*), and Columbian sharp-tailed grouse (*Tympanichus phasianellus*) (Quinn and Parker 1987, Ruediger et al. 2000).

There has been much discussion about the extent to which snowshoe hares cycle in southern boreal forests, as they do in northern forests. Early data suggested that population numbers remained relatively constant in southern portions of the range, similar in numbers to low hare cycles in northern populations. More recent evaluation of the data, however, indicate that hares in southern areas experience fluctuations of two to 25-fold with peaks 8-11 years apart. Peak densities in the south are 1-2 hares/ha whereas they reach 4-6 hares/has in the north (Hodges 2000).

Foraging Areas

Foraging areas for lynx are largely determined by snowshoe hare habitat. Hares are most abundant in early successional stages that include a dense, multi-layered understory with cover and browse that extend from ground level to a height of 4.5 m (15 ft) so that browse and cover are available above snow cover in winter (Ruediger et al. 2000). These optimal early successional stages of understory stem densities and structure are often the result of disturbances such as fire, insect infestations, catastrophic wind events, disease outbreaks, and timber harvest (Agee 2000, Ruediger et al. 2000). Fire is a predominant factor in the west. Areas of high stem density have been defined as >11,250 stems or branches per ha (>4,500/acre) for studies in Washington. This habitat type is dynamic as the young trees will grow, losing fresh growth at the bottom, and their branches will shade out understory saplings and shrubs. Thus lynx foraging habitat is constantly in flux. High snowshoe hare densities can generally be anticipated 30 or so years after a major disturbance such as fire.

Denning Sites

Denning sites require the large downed timber more typically found in mature forests. This coarse woody debris provides protection from predators for vulnerable kittens as well as thermal cover. Multiple natal

dens are typically used. Females require foraging habitat nearby in order to feed their kittens (Ruediger et al. 2000).

Movement Habitat

Lynx in southern boreal forests live in island habitats of mountains surrounded by less suitable lowland habitats. In Wyoming, these lowlands are typically shrub-steppe habitats of sagebrush. Movement between islands of coniferous forest is poorly understood, but occurs on two scales. Large scale movements are probably prompted by low hare abundance and, for subadults, the need to disperse from their natal home range. Lynx in the contiguous United Sates are arranged as metapopulations (McKelvey et al. 2000) [a set of local populations which interact via dispersal of individuals moving among populations and where local extinctions and recolonizations occur (Levins 1970)]. Functioning metapopulations require such occasional movements of individuals between subpopulations for species persistence. Smaller scale movements occur as animals travel between hunting grounds within a home range. Because of the patchiness of lynx habitats in the southern portion of the distributional range, lynx may include areas used primarily for traveling between hunting sites within a home range (Koehler and Brittell 1990).

Lynx have been documented in shrub-steppe habitat, within 40 km (25 miles) of forested habitat, during peaks in jackrabbit populations and it is possible that the occasional availability of such alternate prey may attract lynx to these habitats (Ruediger et al. 2000, Ruggiero et al. 2000b). These shrub-steppe habitats, especially with riparian corridors, facilitate lynx movement from one forested island to another.

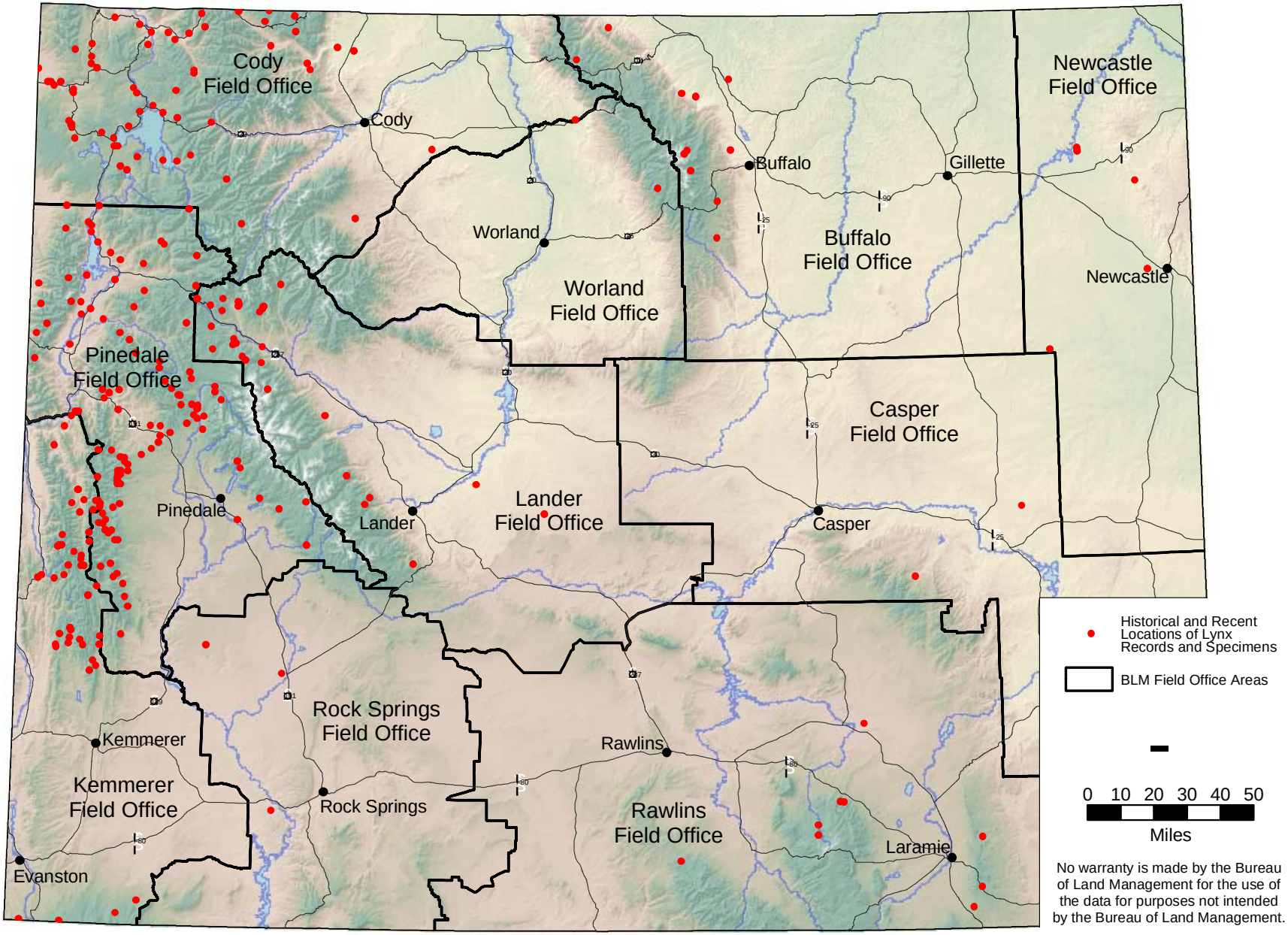
DISTRIBUTION

The Canada lynx lives in the boreal forests of North America from Alaska to Newfoundland, descending into the lower 48 states in northern New England (Maine, New Hampshire, New York, Vermont), the Western Great Lakes region (Michigan, Minnesota, Wisconsin), the Pacific Northwest (Oregon, Utah, Washington), and the Rocky Mountains (Colorado, Idaho, Montana, Wyoming) (McCord and Cardoza 1982).

Lynx have been present in Wyoming prehistorically (Kurten and Anderson 1980) as well as in historic times and the present (Reeve et al. 1986). The best contiguous lynx habitat in Wyoming is in the northwestern portion of the state. The remainder is highly fragmented and widely dispersed, and typically separated by shrublands (WYNDD 2002). The distributions of lynx specimens and reports in Wyoming indicate that they occurred in the mountains of western and northern Wyoming, including the Salt River, Wyoming, Teton, northern Wind River, Gros Ventre, and Absaroka ranges (Reeve et al. 1986); and they also occurred in small numbers in the Uintah Range and the Bighorn Range, and sporadically in eastern Wyoming

The Wyoming Natural Diversity Database (WYNDD) lists lynx as present in Fremont, Lincoln, Park, Sublette, Teton, Uinta, and possibly also Big Horn counties. These records are mapped in **Map 1** and the database that accompanies the mapped records is presented in **Appendix A**. The number of records for each FO is presented in **Table 2**. Lynx surveys were conducted from November 1998 through April 1999 by the Wyoming Game and Fish Department (WGF 1999). The effort focused on three areas: Dubois (Horse, Burroughs, Long, and Warm Springs drainages in the Wind River District of the Shoshone National Forest (SNF)), Merna (Pass, Horse, Spring, Lead, Dry Beaver, South Beaver, Chall, and North Fork Middle Beaver drainages in the Big Piney District of the Bridger-Teton National Forest (BTNF)), and Cottonwood (North and South Cottonwood drainages in the Big Piney District of the BTNF). No lynx tracks were found in the Dubois area, one lynx track was found at Merna, and lynx tracks were

Map 1: Historical and Recent Locations of Lynx Records and Specimens in Wyoming



No warranty is made by the Bureau of Land Management for the use of the data for purposes not intended by the Bureau of Land Management.

TABLE 2 SUMMARY OF THE NUMBER OF LYNX RECORDS BY FIELD OFFICE FROM THE WYNDD DATABASE (WYNDD 2003).

Surface Ownership	Number of Records by Field Office										
	Buffalo	Casper	Cody	Kemmerer	Pinedale	Rawlins	Rock Springs	Lander	Newcastle	Worland	Total
BLM			3	2	7	1	1				14
Forest Service	5		11	44	88	4		23		1	176
Private	6	1	2	4	10	1	1	5	4		34
BIA								3			3
Bankhead Jones									1		1
BOR							1				1
NPS					12						57
Water					1	1					2
State	1	1									4
Total	12	2	61	50	118	9	3	31	5	1	292

Note: There are actually 309 historical records of lynx, however 17 are of sensitive nature (private landowners who have requested information withheld from public scrutiny) and do not contain x & y coordinates. See **Appendix A**.

found six times in the Cottonwood drainage (WGF 1999). Lynx surveys were conducted by WYNDD during the winters of 1999-2000 and 2000-2001 (WYNDD 2001). Two probable and 3 possible lynx trails were found during this survey (Beauvais et al. 2001). These observations occurred in 3 separate areas: Big Sandy, Pine Creek, and Water Canyon.

The recent reintroduction of lynx in Colorado has resulted in a number of collared animals taking residence in the Medicine Bow NF. One den was located, although the female died before kittens would have become independent. Because lynx can move great distances, it is likely that additional animals from Colorado will appear in Wyoming.

Movement

Two lynx were captured and outfitted with radio-telemetry collars in the Wyoming Range, near Big Piney; a male in December 1996 and a female in March 1997 (Squires and Laurion 2000). These animals were followed for a period of three years.

Home ranges of radio-collared lynx in Wyoming over the two to three years of the study were 116 km^2 and 105 km^2 for the male and female, respectively. Winter home ranges were 63 km^2 and 50 km^2, and in the summers they were 81 km^2 and 57 km^2 for the male and female, respectively (Squires and Laurion 2000).

Daily travel distances were 2.2 km to 4.1 km. Exploratory movements of 30 km were made. Hare densities in the Wyoming Range were 0.8 hares/ha in 1997 and 1.4 hares/ha in 1998.

THREATS

There appear to be some notable differences in lynx ecology between southern and northern boreal forests. Snowshoe hare densities are lower and lynx populations appear less stable and at higher risk in the south. The ecological differences between latitudes are likely due to use of alternative prey species; the effect of habitat patchiness on movements, reproduction, and survival; and the potential effects of different communities of predators and competitors (Aubry 2000 et al.).

There is a lot of uncertainty about the complex system that ties lynx, prey, and vegetation together ecologically. This is further affected, in the southern portion of the range, by the complexity of metapopulation dynamics, which are assumed to function in lynx populations (McKelvey et al. 2000a). Southern populations in general are not large, and certain ones likely function as sources and others as sinks, with the necessity of dispersal potential between them. If a source population is put at risk, extinction in both the source and adjacent sink populations can occur. Thus the patchiness and distribution of lynx habitat in the southern part of the range is a major factor in the vulnerability of the species. Maintaining both the habitat within “good” patches and the travel corridors between patches is essential.

Persistence of lynx in the contiguous United States appears to rely upon dispersal from larger populations and maintenance of connectivity between northern and southern populations (Schwartz et al. 2002). For lynx in Wyoming and Colorado, this translates into maintaining connectivity between populations in those two states, and between lynx populations in Canada and Montana, and Montana and Wyoming. Although not documented, the abundance of white-tailed jackrabbits as a significant alternate prey in sagebrush habitats may be a critical factor. Unfortunately, white-tailed jackrabbits appear to be on the decline, as attested by their disappearance from Jackson Hole since 1979 (Berger 2004) and their extirpation from Kansas and southern Nebraska (Chapman and Flux 1990). Other alternate prey in shrub-

steppe habitats may also be used, and may also be experiencing declines (e.g., sage grouse, ground squirrels).

Forest management activities that reduce habitat for snowshoe hares and/or red squirrels will negatively affect lynx. Retention of live and dead trees and coarse woody debris are important factors for maintenance of lynx. In the creation of early successional habitat for snowshoe hares, considerations to include are harvest unit design, selection of sites that can regenerate quickly, choice of fuels practices, retention of coarse woody debris, and maintenance of high stem densities (Koehler and Brittell 1990). Clearcuts, shelterwood cuts, seed tree cuts, and diameter-limit prescriptions that result in distance to cover greater than 100 m (325 ft) may restrict lynx movement and use patterns until forest regeneration occurs (Koehler 1990). In the west, it takes approximately 15 to 30 years for conifers and/or brush species to regenerate to the point where vegetation is available above average winter snow depths and thus provide forage for snowshoe hares, after forest management practices or fire (Ruediger et al. 2000). As the forest canopy develops and shades out the understory, hare populations again decrease. Certain timber harvest practices increase edges and openings within forest stands, which may improve foraging conditions for generalist predators such as mountain lions, coyotes, bobcats, and great-horned owls. Both exploitation and interference competition with lynx may result (Ruediger et al. 2000).

Wildfire management in the west has resulted in forests that are more homogeneous and composed of shade-tolerant species with more canopy layers. These forests are then more susceptible to severe fires, insects, and disease. Salvage logging after a fire may have a negative effect if many or most large-diameter trees are removed (Ruediger et al. 2000).

Recreational trails created by snowmobiles and even cross-country skiers create packed snow conditions which allow other predators and competitors into what would otherwise be exclusive lynx habitat. Coyotes, in particular, tend to gain access into higher-elevation forests by this means. They compete with lynx for prey and sometimes prey on lynx as well. There has been some discussion, however, about the importance of this factor (Root 2003).

It appears that lynx have some degree of tolerance to human activities (Aubry et al. 2000). However, during denning in the spring, lynx are more vulnerable and require more secure habitat and less disturbance than might be tolerated at other times of year. This type of vulnerability to human disturbance may also be exacerbated during periods when food is scarce. Starvation is not uncommon (Aubrey et al. 2000). Developed recreation such as a ski area concentrates the human activity in specific areas and is deserted at night, when lynx would be active (Ruediger et al. 2000).

Roads into areas occupied by lynx may pose a threat to lynx from incidental harvest or poaching, increased access during winter for competing carnivores, especially coyotes, disturbance or mortality from vehicles, and loss of habitat (Aubry et al. 2000, Buskirk 2000, Koehler and Brittell 1990). However, lynx are also known to follow road edges for considerable distances, and also have home ranges that encompass roads or sometimes use them to define the boundary. They seem to not avoid roads (Ruggiero et al. 2000a), although high traffic volume deters them (Apps 2000). The size, type, and amount of use of the road are all likely factors affecting the degree and types of impacts on lynx, as well as the increased vulnerability during denning.

In aspen stands and high-elevation riparian willow communities, extensive grazing by domestic livestock or wild ungulates may reduce forage and cover availability for snowshoe hares, in some cases dramatically. This may also be true for high elevation shrub steppe habitat (high elevation sagebrush communities) that lynx may need and use in highly-fragmented forest stands.

Development of oil wells can be harmful to lynx, mostly as a consequence of new roads created to access areas for exploration and development. The result is increased human use and competing predator use. Mining may directly impact habitat and also promote recreational activities as a consequence of new roads (Ruediger et al. 2000).