



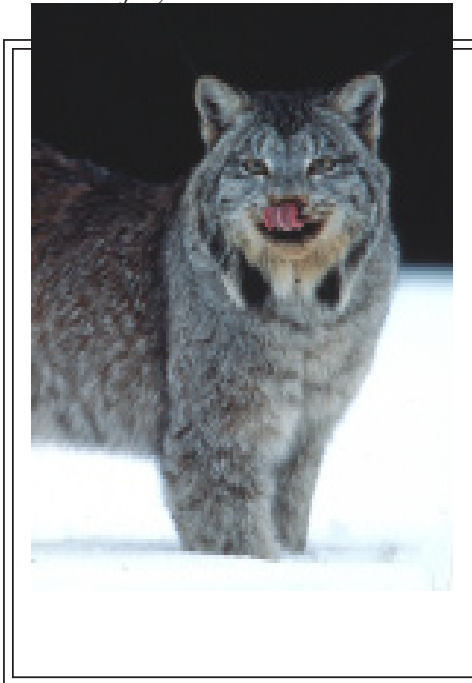
Toward a Better Understanding of the Elusive Lynx

A team of government and university scientists is in the midst of a comprehensive study of Canada lynx – a federally listed threatened species that is the center of much scientific and public debate throughout its range in the United States. In a new book, *Ecology and Conservation of Lynx in the United States*, scientists explore relationships among the lynx, its habitat, and its prey; approaches to conserving lynx; and critical research needs.

A Look at the Cat

The Canada lynx (*Lynx canadensis*) is the only lynx in North America. A rare forest-dwelling cat of northern latitudes, it feeds primarily on snowshoe hares and red squirrels, but also preys on small mammals and birds. Its range extends from Alaska, throughout much of Canada, to the boreal forests in the northeastern United States, the Great Lakes, the Rocky Mountains and the Cascade Mountains. The relative importance of each region to the survival and recovery of the species varies. The Northern Rockies/Cascades region supports the largest amount of lynx habitat in the U.S. and has the strongest evidence of long-term occurrence

of resident populations, both historically and currently. In the Northeast and Southern Rockies, the amount of lynx habitat is relatively limited and its contribution to the persistence of the contiguous U.S. lynx population is unknown.



Background

The spotted owl controversy that crested nearly a decade ago in the Pacific Northwestern U.S. catalyzed heightened concern over the conservation of “sensitive” species on public lands, especially those thought to be negatively affected by land management practices. The Forest Service responded to this concern by identifying a number of species and species groups with the potential to become “conservation issues”. Included were a group of Pacific salmon, the marbled murrelet, Mexican spotted owl, northern goshawk, two species of trout,

several forest owls, and four forest carnivores – one being the Canada lynx.

In late 1993, Forest Service scientists were asked to help assess the state of ecological knowledge for each of these species relative to the information needed for defensible conservation planning.

Findings of the carnivore assessment were published in 1994 by the Rocky Mountain Research Station in *The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx and Wolverine in the Western United States* (available at http://www.fs.fed.us/rm/main/pubs/notsohot_RM/wild_RM.html). One of the main conclusions of this assessment was that “Major information gaps exist for these forest carnivores.” Regarding lynx in the U.S., the assessment read, “...there is a need for the most basic information on habitat relationships, at any spatial or temporal scale and at any level of measurement. Virtually any new data on habitat relationships involving lynx in the western conterminous 48 states would be a substantive increase in knowledge.”

In 1998, knowledge of lynx ecology had not improved substantially since publication of the forest carnivores assessment. Management agencies were thus poorly prepared to deal with the 1998 “proposed rule” by the U.S. Fish and Wildlife Service to list, under the Endangered Species Act, the lynx as a threatened or endangered species throughout its range in the contiguous U.S. (the lynx was formally listed as a threatened species in early 2000 – reference: <http://www.r6.fws.gov/pressrel/00-08.htm>). In response to the situation, Forest Service scientists and authors of the carnivore conservation assessment were asked to address this dilemma. A Lynx Science Team, consisting of seven scientists, and a management team composed of resource specialists from federal land management agencies and state agencies, was assembled to document a scientific basis for conserving lynx. Results of the Science Team have now been published in *Ecology and Conservation of Lynx in the United States*, which brings together and synthesizes virtually all known information concerning lynx ecology, and presents a coherent approach to future lynx research.

Lynx Science Team Leader and Rocky Mountain Research Station Scientist Leonard Ruggiero says, “In this book, we have drawn a clear line between science and policy. Our job as scientists was to summarize the state-of-knowledge, articulate meaningful understandings, and identify important knowledge gaps relative to the information needed for conservation plans and policy. Although the book offers few specific guidelines for managing lynx, it does provide a scientific basis for various policy decisions.”

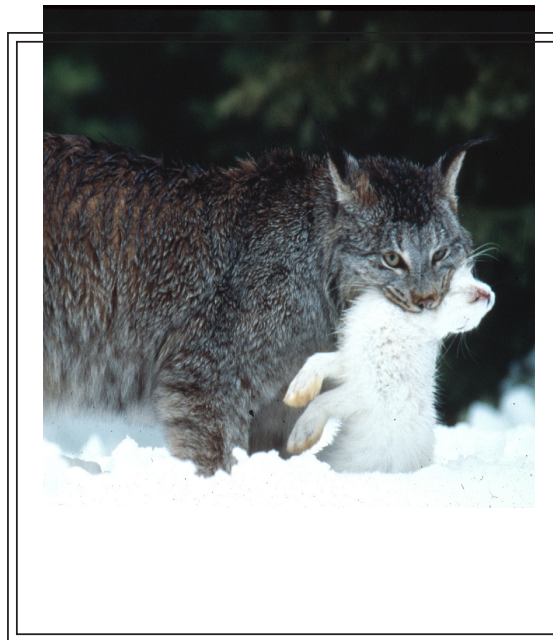
Critical Insights

In the 18-chapter, 480-page book, the authors define a list of important insights that deserve attention. These eleven topics represent crucial areas of ecological understanding relative to species conservation:

- **Present and Historical Patterns of Lynx Distribution:** “Extensive areas of contiguous suitable habitat are needed to ensure viable lynx populations. All areas in the contiguous U.S. where we can state with certainty that lynx currently occur are directly connected to larger habitat areas. Apparently, lynx are unlikely to persist in relatively small, isolated refugia of suitable habitat.”
- **Factors Limiting the Geographic Distribution of Lynx:** “At the broadest geographic scale, lynx distribution is limited to moist, cool boreal forests that support some minimum density of snowshoe hares. Lynx are also limited to areas with snowy winters, likely because of the co-adaptation with hares and because snow gives lynx a competitive advantage over other carnivores. Lynx have morphological adaptations for moving and hunting in snow, as exemplified by significantly lower foot loadings, than most carnivores.

Records from Washington, Wyoming, and Utah/Colorado show that lynx occur at higher elevations as one moves south, with modal elevations of 2,000 m, 2,700 m, and 3,000 m, respectively.”

- **Principal Habitat Features Affecting Lynx:** “A snowshoe hare density greater than 0.5 hares/ha is likely required for lynx persistence. Hare habitat occurs in a range of stand ages, including regenerating disturbed stands and late-seral forests. Regenerating stands can be highly productive for hares, but such stands are temporally transient. Late-seral forests tend to be moderately productive for hares, but also produce ~~are temporally~~ stable. For lynx to persist, a range of stand ages may be necessary to provide adequate habitat for hares and for denning. However, on drier sites where regeneration is sparse, the value of regenerating stands as hare habitat may be diminished relative to the value of late-seral stands.”



- **Food Habits of Lynx:** “Snowshoe hares are the dominant prey of lynx throughout its range (comprising 33-100 % of the diet), but red squirrels are an important alternative prey, especially if hares are scarce. However, available evidence suggests that lynx populations are not likely to persist where snowshoe hares do not predominate in the diet.”

- **Habitat Requirements of Key Prey Species:** “Snowshoe hares are limited to forested landscapes in snowy climates. Hares are closely associated with low, woody vegetation and are most abundant in stands with high densities of small-diameter stems. They are most likely to occur in coniferous stands or mixed coniferous-deciduous stands.

The critical habitat element for hares is horizontal structure, which serves as both food and cover. Reducing dense horizontal structure through silvicultural thinning will likely reduce an area’s carrying capacity for snowshoe hares. Red squirrels are closely associated with mature, cone-bearing coniferous forests. Their densities tend to be highest in late-successional forests with relatively high amounts of coarse woody debris, and generally lowest or absent in regenerating forests that lack cone production.”

- **Population Dynamics of Key Prey Species:** “Some southern snowshoe hare populations fluctuate strongly and, in general, southern populations are likely not as stable as previously thought. Depending on the strength and ubiquity of such fluctuations, southern lynx populations may also be less stable than previously believed. Red squirrel populations fluctuate with conifer cone crops in both the north and south. The fact that populations of these two key prey species exhibit strong population fluctuations has potentially important implications.”

“Your scientists have helped us immeasurably in the very challenging and complex environment surrounding the possible listing of the lynx. They met our initial objective by creating a high-quality, scientifically rigorous document that will be the foundation of the many decisions and other work activities associated with the lynx project. Because of their work, we are confident we are on sound footing as we decide how to better manage the national forests and conserve the lynx.” (Dale Bosworth,

- **Principal Community Features Affecting Lynx:** “Various mammals and birds, including coyotes, cougars, bobcats, fishers, great-horned owls, and goshawks, may compete with lynx. This competition may reduce available food for lynx and may also result in their displacement or death. Increased fragmentation of habitats near the southern periphery of the range, and habitat fragmentation in general, may give generalist predators a competitive advantage over lynx. Cougars often share lynx habitat in the western United States during snow-free periods, and available evidence suggests they may be an important source of lynx mortality. Coyotes appear to be especially effective competitors with lynx in human-dominated landscapes. They have expanded their range into the northeastern United States since 1970 and appear to represent an important factor in lynx ecology there.”

- **Principal Factors Affecting Lynx Movements and Dispersal:** “In northern populations, lynx movements up to 1,000 km have been recorded, and limited data from southern populations documents movements in excess of 100 km. However, even though long-distance movements may be characteristic of lynx populations, we have no empirical basis for tying such movements to successful dispersal. Lynx readily move across landscapes fragmented by conventional industrial forestry.

Although the effect of roads on lynx movements, dispersal, and demographics has not been studied, we have anecdotal accounts of lynx crossing roads of various types. Additionally, we have reliable lynx occurrence records in areas very distant from forested zones. Assuming these lynx were dispersing from the nearest forested areas, highways were crossed prior to their capture. Although limited, these observations do not support the hypothesis that roads represent a significant mortality factor for lynx.”

- **Key Demographic Properties and Dynamics of Lynx Populations:** “Northern lynx populations cycle with hares, and dispersal is highest after hare populations start to decline. We do not know if southern populations behave similarly, but evidence suggests that they are comparable to those lynx are highly in the North and the North population size every year under optimal conditions. Populations in the southern part of the range appear to be small. Small population size, particularly in combination with population fluctuations, predisposes these populations to the risk of local extinction. The probability that such populations will persist depends on many factors, including the degree to which they interact with other populations within a metapopulation structure. Occupancy of habitat islands in a metapopulation will be governed by rates of colonization and extinction. For most of the islands to be occupied most of the time, rates of colonization need to greatly exceed rates of local extinction. Dispersal to distant islands

from other islands with small populations is unlikely, and even successful dispersal frequently will not result in successful colonization. Population size, distance, and barriers to dispersal between islands are therefore critically important to the stability of the metapopulation. The removal of habitat islands through land conversion or through large disturbances increases the distance between the remaining islands, and therefore also decreases colonization rates. To maintain a stable metapopulation, it is critically important to maintain or increase the carrying capacity of all areas capable of supporting lynx.”

- **Geographic Variation Among Lynx Populations:** “Knowledge of geographic variation among populations is important for conservation, yet we know little about how much geographic variation exists among lynx populations. Conventional wisdom suggests that highly mobile species may show little geographic variation, but we cannot assume this for lynx without data, especially considering the broad range of environments occupied by lynx. In general, variation among populations has important ramifications for conservation, including identification of distinct population segments, the consequences of translocations, and the degree to which ecological understandings apply from one population to another.”

- **Direct Human Influence on Lynx:** “Human influences on lynx include trapping and shooting, vehicle collisions, and behavioral disturbance. Evidence from northern areas indicates that when lynx densities are low, human-caused mortality adds to natural mortality. This means that incidental or illegal killing can significantly affect lynx population dynamics under some circumstances. The effects of recreational activities on lynx populations have not been studied. However, limited anecdotal observations do not support the hypotheses that snowmobiling, ski touring, or hiking results in significant behavioral disturbance. Lynx exhibit some indifference or curiosity toward humans, which may predispose them to hunting or trapping deaths. Although there is no empirical basis for concluding that roads represent a major mortality source, fenced roads and highways, or development along transportation corridors, may impede lynx movements.”

Research Continues

Scientists agree that, though these insights provide a crucial foundation for understanding lynx ecology in the United States, critical knowledge gaps still exist. Today, the lynx research program proceeds on several fronts. Rocky Mountain Research Station scientists are conducting studies in Montana, documenting movements and dispersal, and habitat use and selection. Some of their studies are on contrasting sites – one being on a managed (commercial forest) landscape, the other in the Bob Marshall Wilderness. Work is also underway in Wyoming on lynx distribution. Currently, Maine is the only other state where additional lynx research is being conducted.

To locate additional populations of lynx, the Forest Service is currently engaged in a national lynx survey, directed by the Rocky Mountain Research Station. “If we are able to locate other researchable lynx populations,” says Ruggiero, “new intensive studies should be implemented to increase the representativeness of our sample, especially in the southern Rocky Mountains and north-central and northeastern U.S. Furthermore, new lynx studies should be integrated with a broader program of research on forest carnivores and other species of concern so that we can develop the information needed to implement ecosystem management in boreal forest landscapes. We must become more proactive in our research programs if we are to effectively address conservation issues before options for conserving sensitive species have become irrevocably limited,” he says.

Ecology and Conservation of Lynx in the United States is published both on the World Wide Web at http://www.fs.fed.us/rm/pubs/rmrs_gtr30.html, and in hardcopy by University of Colorado, University Press, P.O. Box 849, Niwot, Colorado 80544 (1-800-268-6044). Additional news and information on the lynx is available at <http://www.r6.fws.gov/endspp/lynx..>



Publication Reviews

Status, Ecology, and Conservation of the Southwestern Willow Flycatcher (General Technical Report RMRS-GTR-60)

This publication was prepared in response to a need expressed by southwestern agencies and organizations for a comprehensive assessment of the population status, history, biology, ecology, habitats, threats, and conservation of the southwestern willow flycatcher (*Empidonax traillii extimus*). The southwestern willow flycatcher was federally listed as an Endangered subspecies in 1995. A team of flycatcher experts from multiple agencies and organizations identified components of the publication, wrote chapters, and cooperatively assembled management recommendations and research needs. This publication should prove useful in conserving populations and habitats of the southwestern willow flycatcher. Financial assistance for preparing this report was provided by the Southwest Region and Rocky Mountain Research Station's Rio Grande Ecosystem Program of the U.S. Forest Service. It is available electronically on the Station's website at http://www.fs.fed.us/rm/pubs/rmrs_gtr60.pdf.

The Northern Goshawk in Utah: Habitat Assessment and Management Recommendations

This assessment describes northern goshawk (*Accipiter gentilis*) habitat in the State of Utah. Because of fire exclusion, insect and disease epidemics, timber harvest, livestock grazing, or a combination of these factors, the forests and woodlands of Utah have changed drastically since the early 1900's. Forests are now dominated by mid- and late-successional species (Douglas-fir, white fir, and subalpine fir) rather than the early successional species (lodgepole and ponderosa pine). Along with these changes came suspected declines in goshawk populations. Goshawk habitat in Utah was assessed using potential vegetation types, current vegetation types, and expert knowledge. Subalpine fir (17 percent) and quaking aspen (10 percent) potential vegetation types were the most common forest types in the State. Nearly 95 percent of the subalpine fir potential vegetation type was rated as high or medium for nesting habitat, while nearly 90 percent of the quaking aspen potential vegetation type was rated as high or medium for nesting. Similarly, combining nesting and foraging preferences 70 percent of the subalpine fir potential vegetation type is rated as either high value or optimum habitat. In addition, throughout Utah all of the high value habitats are well connected. The present conditions of the forests and woodlands of Utah are prone to insect and disease epidemics in addition to the risk of stand replacing fires. To ensure the goshawk's continued existence in Utah will require the restoration of these degraded habitats and the protection of native processes. This publication is available electronically on the Rocky Mountain Research Station's website at http://www.fs.fed.us/rm/pubs/rmrs_gtr22/goshawk.html.

RMRSscience is a quarterly report from the USDA Forest Service's Rocky Mountain Research Station. Each issue highlights on-going or recently completed research, and features findings useful to land managers and other natural resource specialists...a tool for getting research results into the hands of users. To be added to the mailing list, free-of-charge, write RMRSscience, Rocky Mountain Research Station, 2150 Centre Ave., Bldg. A, Fort Collins, CO 80526; or e-mail cletcher@fs.fed.us; or fax (970) 295-5927. Comments and suggestions are always welcome.

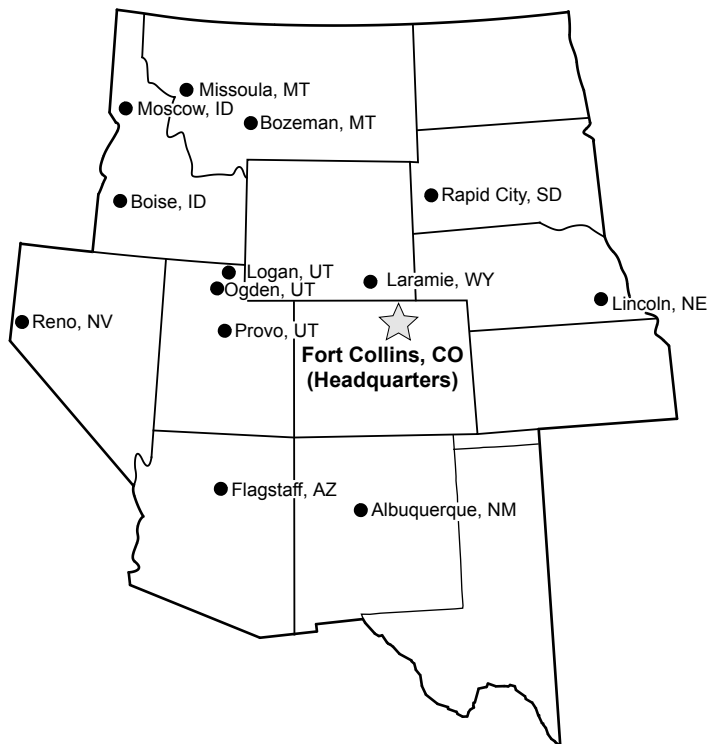
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