



Management of Forests and Forest Carnivores: Relating Landscape Mosaics to Habitat Quality of Canada Lynx at Their Range Periphery

PAPER BY Joe Holbrook, John Squires, Barry Bollenbacher, Russ Graham, Lucretia Olson, Gary Hanvey, Scott Jackson, Rick Lawrence, and Shannon Savage

Brief by Kit Freedman

Illustrations by Kayla Matlock

Why this study was needed

A major challenge in the conservation of threatened and endangered species is the lack of understanding about how habitat influences population performance. While it is relatively easy to identify the habitats and areas a threatened species uses, it is much more difficult to understand how habitat characteristics or quality relate to a population's reproduction and survival. Without an understanding of how habitat influences population performance, forest managers struggle to determine how recreation, timber harvest, or any other human activity impacts a species or population.

Provided the absence of available research that can help guide forest managers in determining how best to manage lands and promote quality habitat for the conservation of threatened or endangered species, the researchers in this study aimed to clarify what types of forest environments are associated with high-quality habitat for Canada lynx—a threatened forest carnivore occupying the Rocky Mountain region of the continental US.

How it was done

The study brought together data from multiple studies to evaluate characteristics of high-quality habitat for Canada lynx across an expansive landscape of mixed-conifer forests in northwestern Montana. Researchers employed tracking data from 32 radio- and GPS-collared females over 14 years (1999–2013) to estimate the ranges occupied by the lynx, along with records of when each female produced kittens. The researchers also surveyed the study area for presence and density of snowshoe hares—a primary food source for Canada lynx. Finally, researchers used satellite imagery to evaluate the distribution and arrangement of forest structural types, such as older multistoried forests, advanced regenerating and dense forests, and open canopy forests, within the home ranges of adult female lynx.

The researchers combined the GPS, snowshoe hare, and satellite imagery data sets into a series of models to better understand the relationship between the composition and arrangement of forest structural types and the likelihood of a female producing a litter of kittens.

Read the paper

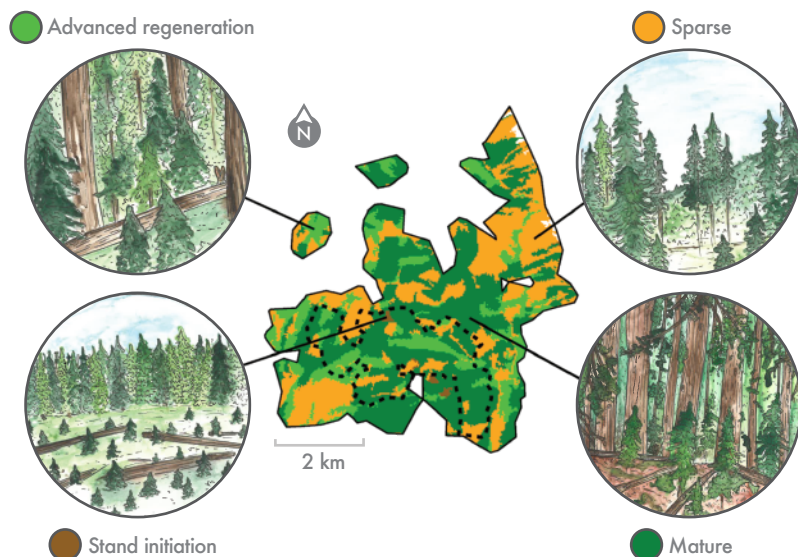
J. D. Holbrook, J. R. Squires, B. Bollenbacher, R. Graham, L. E. Olson, G. Hanvey, S. Jackson, R. L. Lawrence, and S. L. Savage. 2019. "Management of forests and forest carnivores: Relating landscape mosaics to habitat quality of Canada lynx at their range periphery." *Forest Ecology and Management*, 437: 411–425. DOI: <https://doi.org/10.1016/j.foreco.2019.01.011>

What they found

The researchers identified distinct differences in the quantity and arrangement of forest structural types between the ranges of the female Canada lynx most likely to produce kittens compared to those least likely to produce kittens. Specifically, sections of mature, multistoried forest were more abundant and better connected in the areas occupied by the most productive females. In addition, snowshoe hare density was highest in areas of advanced regeneration, followed by mature, multistoried forest. Thus, the authors conclude that a high-quality home range for adult female Canada lynx can be best characterized as a forest mosaic with abundant (approximately 50 percent) mature forest and intermediate amounts (approximately 20 percent) of advanced regeneration, with the remaining 30 percent composed of structural types with more open canopy cover.

The researchers used these results to develop an assessment framework forest managers can use to evaluate management alternatives to improve habitat quality for Canada lynx by enhancing the reproductive success of females.

Female 70 home range and forest use types



Example of forest structural classes and arrangement in the home range and core use area (dashed line) of a female Canada lynx in northwestern Montana. She produced 7 litters of kittens in 7 years of monitoring from 2001-2007, illustrating that a home range for a productive female includes a mosaic of forest structural classes, and that a core use area (50% of use) is characterized by mature patches of forest with high connectivity.

Why it's important

By identifying habitat attributes that contribute to reproductive success for female Canada lynx, this study helps narrow the gap between on-the-ground forest management and the conservation of a federally threatened species. In this instance, the researchers leveraged several new and existing datasets to develop an evaluation framework that can assist resource managers faced with the difficult task of balancing multiple objectives while managing forests occupied by a threatened carnivore, the Canada lynx. This study serves as an example of how researchers can advance ecological insights while also developing authentic on-the-ground applications to serve the conservation of threatened and endangered species.

About the researchers

This research was conducted through the collaboration of scientists and managers affiliated with the USDA Forest Service Rocky Mountain Research Station and Department of Land Resources and Environmental Sciences at Montana State University in Bozeman, Montana.

- Joe Holbrook, assistant professor, Haub School of Environment and Natural Resources and Department of Zoology and Physiology, University of Wyoming, Laramie, WY
- John Squires, USDA Forest Service Rocky Mountain Research Station, Missoula, MT
- Barry Bollenbacher, USDA Forest Service Rocky Mountain Research Station, Missoula, MT
- Russ Graham, USDA Forest Service Rocky Mountain Research Station, Moscow, ID
- Lucretia Olson, USDA Forest Service Rocky Mountain Research Station, Missoula, MT
- Gary Hanvey, USDA Forest Service, Missoula, MT
- Scott Jackson, USDA Forest Service, National Carnivore Program, Missoula, MT
- Rick Lawrence, Department of Land Resources and Environmental Sciences, Montana State University, Bozeman, MT
- Shannon Savage, Department of Land Resources and Environmental Sciences, Montana State University, Bozeman, MT



UNIVERSITY
OF WYOMING

William D. Ruckelshaus Institute of Environment & Natural Resources
(307) 766-5080 | uwyo.edu/haub | ruckelshaus@uwyo.edu