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Here Today, Here Tomorrow: Managing Forests for Fisher Habitat in the Northern Rockies

*The fisher (*Pekania *[Martes]* pennanti*) is an endemic weasel species found mostly in Canada, but there are populations in the Pacific Northwest, the upper Midwest, the northeastern United States, and the northern Rockies. Fishers are currently designated as a "sensitive species" in both the USFS Northern and Intermountain Regions so forest managers are benefiting from Rocky Mountain Research Station science on fisher populations and habitat requirements (photo by USDA Forest Service).*

SUMMARY

The fisher is a unique member of the weasel family and a sensitive species in the northern Rockies. They were almost extirpated by trapping in the early twentieth century, but these animals (a mix between a native and introduced population) now inhabit a swath of mesic coniferous forests in Idaho and Montana. Forest managers need information on fisher distribution and habitat needs to conserve this species while balancing multiple uses of forest lands and to maintain fisher populations under climate change.

Hard to find and track on the landscape, RMRS researchers have collected hundreds of DNA samples via hair snares, which provide genetic and locational information. Matching DNA samples to habitat features at various scales, the animals were found to choose habitat at both the stand- and the landscape-scale, requiring large trees and forests with a lot of cover and structure, all nested within a larger forested landscape. Researchers are using DNA data to create fisher distribution maps that can be used for forest planning or decisionmaking in the field. Models of fisher habitat in the future under a warming climate suggest that the amount of favorable area is likely to expand and move eastward into the Interior West, but it could become more fragmented. The amount of suitable habitat for fishers will also depend on the minimum usable habitat patch size and distances that animals are able to disperse through unfavorable habitat. Now and in the future, fisher management will require retention and fostering of mature, complex, mesic forests with a high degree of habitat connectivity.

Hiking through the forests of the northern Rockies, your likelihood of a casual fisher encounter is zero to none. Stealthy and sparsely distributed on the landscape, these cat-sized members of the weasel family are the embodiment of the word "elusive." They move quietly through the forests largely unseen, even by the very wildlife biologists who may set live traps for years to capture and track a mere handful of these animals.

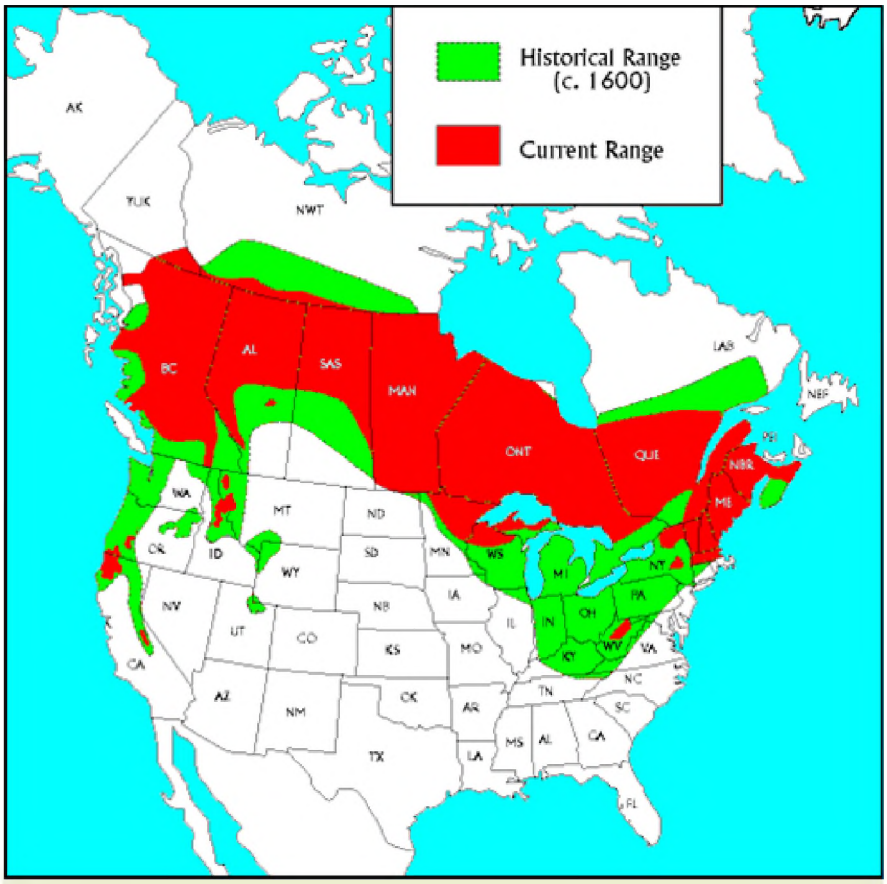
Fishers (*Pekania* [Martes] *pennanti*) are endemic to North America—they are found mostly in Canada, but there are populations in the Pacific Northwest, the upper Midwest, the northeastern United States, and the northern Rockies. Thought to be extirpated from the northern Rockies by the early twentieth century due to over-trapping and possibly by changes in forest structure, fishers were reintroduced to the area starting in the late 1950s by foresters.

National Genomics Center for Wildlife and Fish Conservation

The National Genomics Center for Wildlife and Fish Conservation, located within the USDA Forest Service's Rocky Mountain Research Station, uses genomics to study and monitor natural populations of wildlife and fish on public lands. Genomic research involves the collection of genetic information (DNA sequences) at thousands to millions of locations in the genetic code of organisms. Genomics often focuses on mapping DNA sequences and understanding their interactions and functions. The National Genomics Center is developing cost-effective monitoring tools that use genomic methods, while providing state-of-the-art scientific understandings about important natural resource issues.

Until recently, little was known about the status and habitat requirements of fishers in this region, but this information is needed by forest managers who must comply with evolving U.S. Forest Service (USFS), U.S. Department of Agriculture, management regulations. Mike Schwartz—a wildlife biologist at the Rocky Mountain Research Station (RMRS) and the director of the USFS National Genomic Center for Wildlife and Fish Conservation—has been working with colleagues and regional partners for decades to shed some light on the matter. "We're using everything from the best satellite technology to the latest and greatest in genomics to understand where these animals are and what they need now and in the future," he says.

The fisher is currently designated as a "sensitive species" in both USFS Northern Region (western Montana and Idaho) and Intermountain Region (central to southern Idaho). This designation (under the 1982 Planning Rule) directs the USFS to manage forests for fisher habitat to ensure that they do not become federally endangered or threatened in these areas. In 2012, the USFS developed new planning regulations, in accordance with the National Forest Management Act (NFMA), that represent a significant change in Federal forest policy, with implications for wildlife populations that are still being sorted out. Under the 2012 Planning Rule, the Regional Foresters are responsible for identifying and listing "species of conservation concern" for their forests. Managers then have to design "desired conditions" of their forest plan to provide the habitat conditions that can enable these species to persist. To do this effectively for small, elusive carnivores like the fisher, managers need the best and most current information available, both at the stand/site and the landscape level.



Fishers are found only in North America—mostly in Canada, but there are populations in the Pacific Northwest, the northern Rockies, the upper Midwest, and the northeastern United States (adapted from Lewis, J.C.; Stinson, D.W. 1998. Washington State Status Report for the Fisher. Olympia, WA: Washington Department of Fish and Wildlife).

FISHER PELTS AND PORCUPINES

It is hard to know how many fishers were in the northern Rockies in the 1850s when trapping of this species started in earnest—there are no reliable records. There are accounts from the 1920s of fisher pelts selling for the exceptional price of $345— equivalent to 7 months salary for a logger at the time—amplifying trapping pressures and possibly causing local extinctions. Historical records show that when fisher pelt values were at their highest, trappers would pursue an individual fisher for days. Not surprisingly this kind of pressure caused fisher numbers to plummet, and by 1930 they were thought to be extirpated from the northern Rockies, essentially "trapped out."

The fisher is one of the few carnivores that specialize on eating porcupines, a rodent species that can kill young trees by eating their bark and cambium (photo by the National Park Service).

Obviously, lack of fishers was a lost-income issue for trappers, but the repercussions were more widespread. Despite their name, fishers are not huge consumers of fish, and although they can use a wide variety of prey, they are one of the few carnivores that specialize on porcupines (*Erethizon dorsatum*). According to Schwartz, "In the 1950s, there was a boom in porcupines, which girdle and kill young trees. The foresters said, 'We have to do something here—what preys on porcupines?' In the Rockies, that is mountain lions to some extent, and fishers to a large extent." Accordingly, plans were made to bring these animals back to the northern Rockies landscape.

Fisher reintroductions to the area started in 1959, when the (then called) Montana Department of Fish and Game relocated 36 fishers from central British Columbia (BC) to the Purcell, Swan, and Pintler ranges in northwestern and west-central Montana. Idaho Fish and Game followed in 1962 with another relocation of 42 animals from central BC to north-central Idaho (including the Bitterroot Divide). The third wave of fishers to be reintroduced came from the upper Midwestern United States, with 110 of these animals landing in the Cabinet Mountains of northwestern Montana between 1989 and 1991. In the end, a total of 188 animals were relocated from BC and the upper Midwest over about three decades, with the hope that this would be enough for fisher populations to reestablish themselves in the northern Rockies.

As you might expect, relocated animals disappeared into terra incognita after being released so their post-release fate was mostly…uncertain. "These animals were not tracked very well after their release," says Schwarz, "No one monitored the response." There was early anecdotal evidence of success; new fisher captures and sightings were reported in Montana a few years after the 1959 releases and in Idaho by the late 1970s. But by the 1990s, the general consensus among wildlife biologists and conservationists was that the post-reintroduction fisher geographic distribution and population size in the Rockies was largely a mystery requiring study.

Fishers from British Columbia were released in Olympic National Park in 2009. Similar efforts to reintroduce the fisher occurred in Montana and Idaho in 1959, 1962, 1989, and 1991 (photo by the National Park Service).

COLLECTING FISHER DATA WITH A BOX, SOME RAW CHICKEN, AND A FEW GUN BRUSHES

One of the first lines of business in any wildlife research program is to figure out exactly where the animals are so that their habitat requirements and use patterns can be understood. Scott Jackson, National Carnivore Program Lead located with the USFS Northern Region, says that this research is needed in the northern Rockies because of the high likelihood of management actions in fisher habitat. Wolverines (*Gulo gulo*)—another member of the weasel family that is often in the conservation spotlight in the northern Rockies—mostly inhabit the higher elevations where less forest management occurs. "But Forest Service activities," Jackson explains, "have the potential to have more of an effect on fishers because they are living in the mid-elevation areas where we are more likely to conduct management operations, so we need the kind of information that Mike and his colleagues are working on."

Fishers are hard to spot because of their low population density, patchy distribution, and the sheer vastness of the northern Rockies. Schwartz admits, "We know we can build live traps and catch them, but only where the populations are at a reasonable density. Where they are less common, you could trap for 3 or 4 months and not catch one." A study published by Schwartz and his colleagues explored the movements of radio-collared females from the Clearwater River drainage in Idaho, which is thought to have the densest population of fishers in the northern Rockies. In 4 years they were able to capture only 11 mature females to fit with tracking collars (34 animals overall—only females were tracked due to their importance in driving population dynamics). Live traps have the added disadvantage of requiring constant monitoring for ethical reasons.

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A technique now employed by Schwartz's lab known as "non-invasive genetic sampling" avoids many of the

typical pitfalls of live traps. In a nutshell, cells of an animal are collected for genetic analysis without capture and handling. These cells can come from hair, skin, feces, or urine, which all are rich in DNA. Schwartz is a proponent of this data collection method because, "It's very cost effective and there is so much we can do with the information."

For fishers, a DNA-collecting device that works well is an open-ended triangular box that collects the animal's hair using side-mounted metal gun brushes (normally used for cleaning out gun barrels). "The animal walks in, and while it is chewing away on the meat bait in the middle, it is rubbing its back and sides against the brushes and leaving us all sorts of hair in the bristles," reports Schwartz. Over an 8-year time period, roughly 5,000 hair snares like this have been deployed throughout the northern Rockies with the help of research partners Montana Fish, Wildlife, and Parks, Idaho Fish and Game, the Potlatch Timber Co., the Nez Perce tribe, and Clearwater Forest Industries. These snares have yielded approximately 300 fisher DNA samples in Montana and Idaho.

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A DNA-collecting device that works well for fishers is an open-ended triangular box that collects the animal's hair using side-mounted metal gun brushes (photo by Michael Schwartz, USDA Forest Service).

"ALIEN" FISHER DNA: WHERE DID IT COME FROM?

Fisher genetic samples can track the success of the reintroduction efforts, since animals from different regions have unique DNA profiles. Looking at the DNA of fishers collected from the Cabinet Mountains, Schwartz and colleagues (including Ray Vinkey, a former University of Montana student now at Montana Department of Fish, Wildlife and Parks), found they had a genetic profile that is exactly like those in the Midwest today. He declared this finding "not shocking" as 180 animals from the Midwest were dropped off here between 1989 and 1991.

In the Bitterroots, however, where all of the reintroductions were of BC origin, there was an irregularity in the fisher DNA. According to Schwartz, "About half of the signal looks like it's from BC, but the other half of the DNA looks nothing like we've seen before—it looks alien, like it comes from Mars." His best explanation doesn't actually invoke a Martian origin; he and colleagues suggest that possibly a remnant population of fishers in the mild, moist conditions of the Clearwater River region survived the extirpation and are now intermixed with the reintroduced animals in the Bitterroots. But how could this be verified?

Although the collectors of museum specimens couldn't have predicted it at the turn of the century, these dusty old relics can be the source of priceless

An American marten (Martes americana), another member of the weasel family, next to a hair snare used by Schwartz, Olson, and their partners to study fisher populations and their habitat. Over an 8-year time period, roughly 5,000 hair snares were deployed throughout the northern Rockies with the help of research partners Montana Fish, Wildlife, and Parks, Idaho Fish and Game, the Potlatch Timber Co., the Nez Perce tribe, and Clearwater Forest Industries (photo by Robin Garwood, USDA Forest Service).

DNA for solving mysteries such as this one. According to Schwartz, "We decided to try to find some samples of fisher tissue from the area that would have predated the reintroduction. We looked everywhere and found nothing. Then, miraculously, we found one old fisher sample at Harvard University." The fisher had been collected in 1896 from the Clearwater River basin and was found to have the exact same genetic profile as the mysterious fishers from the Bitterroots. This indicated that some remnant of the original northern Rocky Mountain fisher population survived the early 20th century fur rush and that their descendants persist in the population today—good news by any measure.

MANAGING FORESTS FOR THE FISHER NOW…

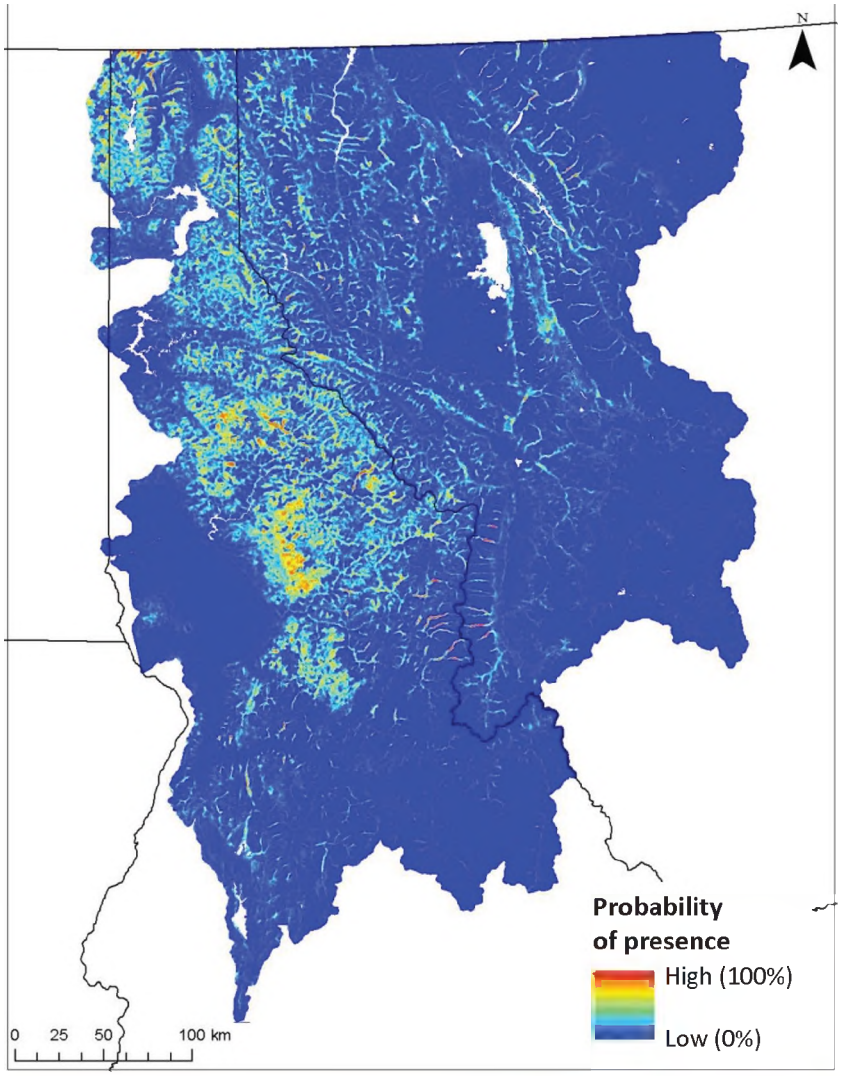
Fisher habitat needs have not been as well studied in the northern Rockies as they have in the Pacific Northwest and California. According to Barry Bollenbacher, the Regional Silviculturist for the USFS Northern Region, "The fisher are currently considered a 'sensitive species' here, and will be considered for 'species of conservation status' under the new Planning Rule as forest plans are revised, and so are pretty high profile in terms of management. We are still in the early stages of trying to understand their requirements."

The current range of fishers in the northern Rockies seems to be limited to Montana and Idaho. There are anecdotal

"The fisher are currently considered a 'sensitive species' … and so are pretty high profile in terms of management. We are still in the early stages of trying to understand their requirements," according to Barry Bollenbacher, the Regional Silviculturist for the USFS Northern Region.

reports of fishers in Wyoming, particularly at Yellowstone National Park, but, "After a pretty extensive effort, we've never found any there," reports Schwartz. Focusing on the broad geographic area where fishers are known to be, the initial approach taken by Schwartz and his colleague Lucretia Olson, an RMRS ecologist based in Missoula, was to ask—which habitats are they choosing to use? They used correlations between fisher presence (using both telemetry and the hair snare data) and specific forest habitat features where the animals were detected to answer this—analogous in some ways to using a widespread sample of your fingerprints collected across town to figure out if you're more likely to be found in a coffee shop or a fitness center.

Schwartz and Olson found that fishers in the northern Rockies were strongly associated with more mesic forests dominated by trees like grand fir (*Abies grandis*), western hemlock (*Tsuga heterophylla*), and western red cedar (*Thuja*



The current distribution of fishers modeled for Montana and Idaho, with the highest areas of predicted occurrence found in the Lochsa area/Clearwater River subbasin (figure by Lucretia Olson, USDA Forest Service).

plicata) and that have lots of cover and a high degree of habitat complexity. The most important predictor of fisher occurrence in the model was the presence of tall trees (25 to 50 meters), highlighting the importance of mature, structurally complex forests for these animals. The highest concentration of fishers was in the Lochsa area (also known as the Clearwater River subbasin) of Idaho. "The Lochsa is really different from the areas around it — it feels like you're in the Pacific Northwest. There are enormous cedar trees, and it's a little warmer, a little wetter, and a little lower in elevation. It's also a hotspot for fishers," says Schwartz. Conversely, they found that the animals actively avoided the drier forests of the northern Rockies dominated by ponderosa (*Pinus ponderosa*) and lodgepole pines (*P. contorta*), possibly because of their need for adequate cover and the lack thereof in these forest types.

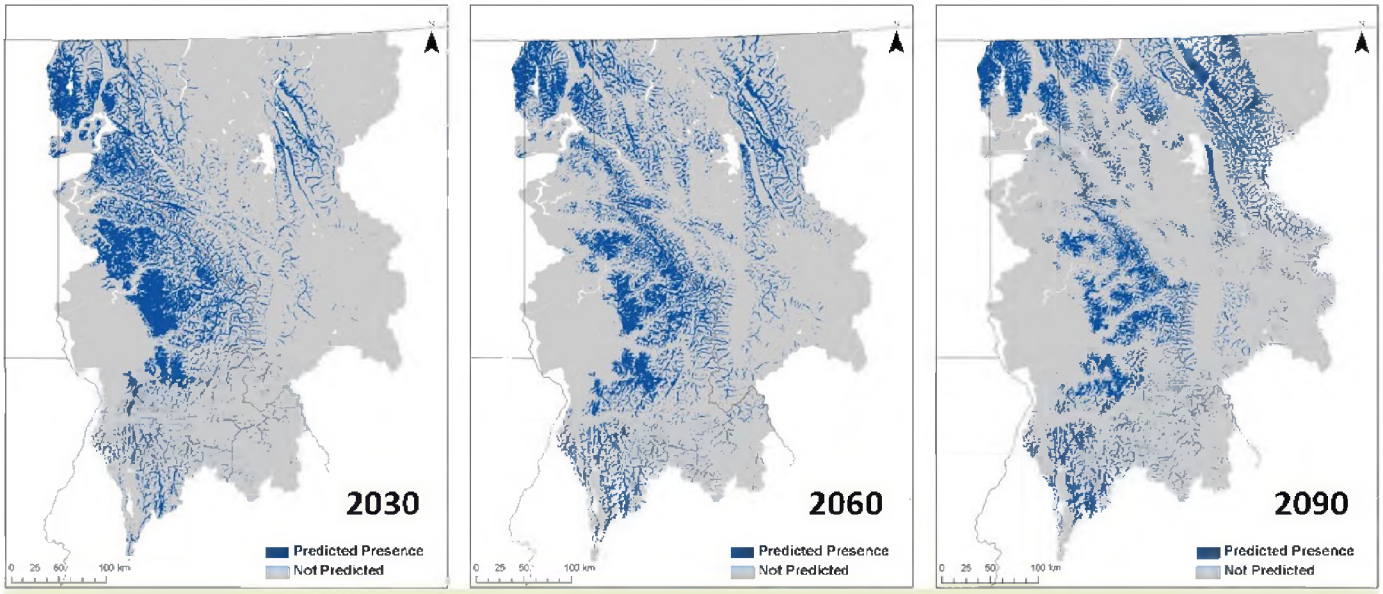
Just as important as the trees in a given stand, though, was the larger landscape. Fishers selected not only sites with large-diameter trees, but they preferred forested regional landscapes with these trees as well. For example, while fishers may be found in small riparian habitats embedded in a more open landscape, this is not the type of habitat that would be expected to sustain a population so it is more likely that they are just moving through it or using it in the short term. "Fishers select habitat at multiple scales, so you really have to look at the entire forest rather than just improving an element. They need to have some big trees, some variation in tree widths, forests with some habitat structure, and those forests have to be nested within a larger forest," says Schwartz. Forest management that promotes the growth of multi-age stands with a lot of structure can enhance fisher habitat. Other activities that can preserve or enhance fisher habitat are retaining larger trees, preserving dead or declining trees, creating snags, and increasing woody debris.

"Fishers select habitat at multiple scales, so you really have to look at the entire forest rather than just improving an element. They need to have some big trees, some variation in tree widths, forests with some habitat structure, and those forests have to be nested within a larger forest," explains Michael Schwartz (Director of the National Genomic Center for Wildlife and Fish Conservation).

Knowing the habitat features associated with these animals, researchers can model and map the likelihood of fisher occurrence. "With the measured range of conditions that fishers prefer," explains Olson, "we can produce a map showing a 0 to 100% probability of how likely you are to have a fisher occur in a given area in your forest." Their original map was produced using a vegetation-based map layer from LANDFIRE (a national, publicly available planning tool with various geo-spatial data layers), but the researchers are currently working on additional steps to make the maps more useful to forest managers in the field. "Managers have told us that they want to use VMAP (Vegetation Mapping Program) for planning, and so we have worked with Region 1 [USFS Northern Region] foresters to get this information onto their map layers," says Olson. These types of fisher distribution maps and habitat models will help the Regional Foresters to make management decisions that comply with the new 2012 Planning Rule for species of conservation concern.

...AND MANAGING FORESTS FOR FISHERS IN THE FUTURE WITH CLIMATE CHANGE

Having developed maps of where fishers are most likely to be found in the northern Rockies, Schwartz and his colleagues turned their attention to projecting how potential fisher habitat might change in the future with a warming climate. According to Schwartz, "Depending on your assumptions, the world either gets better or worse for fishers."



The northern Rockies become warmer and wetter under predicted climate scenarios with no abatement of fossil fuel use, and the model VMAP predicts that fisher habitat moves eastward and suitable habitat area increases 24% over current levels by 2090, as shown above. The expanded habitat is fragmented, however. If fisher dispersal distances are limited to 1 km (0.6 miles) through agricultural land and urban areas, the model predicts a 26% loss in fisher habitat compared to current levels (figure by Lucretia Olson, USDA Forest Service).

KEY FINDINGS

- Fishers were thought to be completely extirpated from the northern Rockies in the early 1900s, but surprising research revealed a native lineage that survived and is now intermixed with animals that were reintroduced to the area from British Columbia and the upper Midwestern United States.
- Fishers in the northern Rockies prefer mesic forests with large trees and a lot of habitat structure and cover, and they actively avoid areas with no cover.
- Fishers select habitat at two scales: a stand scale, with large trees and a wide variation in tree size, and a landscape scale, with a preference for landscapes with a high proportion of large trees.
- Models indicate that the amount of fisher habitat may increase and move farther east under a warming climate, but it might also become more fragmented. This makes the ability of fisher to use future habitat dependent on minimum size of usable fragments and their ability to disperse through unsuitable habitat.

Under future climate warming scenarios, the northern Rockies are projected to experience warmer temperatures, with more precipitation falling as rain than snow. Habitat for the mesic-forest conifers used by fishers in the northern Rockies is expected to expand farther into the mountain ranges of the Interior West. Overall, a warming climate could lead to an increase in the total amount of potential fisher habitat in the northern Rockies by 24% over current levels by the year 2090.

Is this good news for fishers? It is hard to say, and depends a lot on asking "what if" questions in the model. One of the questions Olson and Schwartz asked was—what if fishers can't use smaller forest fragments, as has been suggested by previous research? "The big block of habitat that we see for fishers currently in the Rockies disappears because it gets too dry," says Schwartz. "One of the things I worry about is that there may actually be more habitat to the east in the future, but it may be more fragmented into smaller areas." When the researchers set a minimum habitat size of 125 km^2 (30,890 acres) in their model, the amount of suitable fisher habitat under current conditions declined by 22%, with lower future gains projected under warming conditions. And this assumes that the animals can move freely between these patches, which is not likely to be the case.

The actual dispersal distances of fishers in the wild are largely unknown and probably quite variable. Fishers are capable of long-distance movements (one juvenile male in Schwartz' study moved at least 92 km (57 miles) across a remote wilderness), but generally don't move far, which may be related to their reluctance to move through areas with low or no cover where they are more vulnerable to predation. Fragmented habitat can make it more difficult for the animals to locate and move to new areas. Looking at the habitat map projections under climate change, Olson wondered what the outcomes would be if the fishers couldn't successfully move into these new habitat areas. "So we also incorporated dispersal abilities into the models to see how that would affect availability of new habitat," she says.

"When you're thinking about keeping these animals on the landscape in the future, connectivity of habitat is very important," says ecologist Lucretia Olson.

MANAGEMENT APPLICATIONS

- Fishers are listed as a "sensitive species" in the USFS Northern and Intermountain Regions and may be listed as a "species of conservation concern" under the new 2012 Planning Rule, requiring that their habitat needs are incorporated into forest planning and management.
- Non-invasive genetic sampling is a powerful tool for collecting data on wildlife species like the fisher without having to capture and handle the animals. The National Genomics Center for Wildlife and Fish Conservation is a world leading Center that has specialized in non-invasive genetic sampling studies.
- To provide the best habitat for fishers, management activities should promote the growth of multi-stage stands with ample structure and variation in tree widths and ages.
- The minimum habitat area and dispersal ability of fishers are not well understood, and so maintaining connections between suitable habitats is important now and in the future under a warming climate where habitat may become more fragmented.

Mike Schwartz and field crew members measure a live-trapped fisher on the Clearwater National Forest in Idaho (photo by USDA Forest Service).

The mountain ranges in the northern Rockies have large, intermountain valleys that are often arid and highly developed, lacking the cover that fishers need for long-distance dispersal. The maximum dispersal distance used in the model was 10 km (6.2 miles)—thought to be within the dispersal ability of these animals in high-quality habitat, but probably less realistic in a fragmented landscape. The model predicts that the amount of fisher habitat will increase only if they are able to successfully move 4 km (2.5 miles) or more through unsuitable, hostile habitat. "In the future, fishers will need to be able to have corridors or some areas that they can move through. Their prospects are much bleaker if everything is split by roads, or urban or arid areas," says Olson, adding, "When you're thinking about keeping these animals on the landscape in the future, connectivity of habitat is very important."

And keeping fishers on the landscape is important for the USFS to think about now and plan for in the future. According to Bollenbacher, research on the habitat needs of sensitive species such as the fisher and Canada lynx (*Lynx canadensis*) has been instrumental in changing and clarifying managers' views of what they require, but he believes that we are still in the early stages of understanding the fisher. He explains, "We know generally that they [fishers] are drawn to big trees and rotten trees, but we don't have the specifics yet. For example, how many big trees on a particular acre, or how many big logs? Do all the trees in the stand need to be big? There is still a lot to be learned about the structure they need, and more work to be done to understand them."

The other big questions for fisher relate to ecosystem change. Schwartz notes, "We know very little about how changes in the suite of forest carnivores recovering in western forests—such as wolves, bears, marten, bobcats, and mountain lions—influences this mid-trophic-level carnivore. Understanding how habitat management relates to the ecological interactions among species is an essential question." In the pursuit of this, it is essential that research silviculturists and biologists work with management counterparts in National Forest Systems to develop appropriate desired conditions that can be incorporated into forest plans. Such desired conditions might address stand-level composition and structure as well as landscape-scale patterns and processes, mirroring the multi-scale habitat needs of fishers and many other forest species. These working relationships can build a framework for sustaining both resilient forests and fisher habitat over the long term.

FURTHER READING

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The following scientists were instrumental in the creation of this Bulletin.

MICHAEL SCHWARTZ is the director of USFS National Genomics Center for Wildlife and Fish Conservation in Missoula, Montana. He earned his MSc in Ecology and Evolution at American University and his PhD in Wildlife Biology from the University of Montana. His research focuses on the fields of population, conservation, and landscape genetics/genomics, with an emphasis on research that provides practical answers to natural resource problems. Michael was honored as one of the "2015 World's Most Influential Scientific Minds" and was named as one of the "Most Highly Cited Researchers of 2015" by Thomson-Reuters.

LUCRETIA OLSON is an Ecologist for the Rocky Mountain Research Station in Missoula, Montana. She earned her PhD in Ecology and Evolution from the University of California Los Angeles. Her main research interests are using spatial and population ecology to better understand the distribution, stability, and habitat use of wildlife species. Lucretia's current projects include modeling distribution and habitat selection of forest carnivores (lynx, wolverine, and fisher) in Idaho and western Montana using GPS and genetic data.

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