United States Department of Agriculture
Forest Service

PNW Pacific Northwest Research Station

Science FINDINGS

issue one hundred eighty one / january 2016

INSIDE

"Science affects the way we think together."
Lewis Thomas

Watching What Wildlife Want and Need

"It's the flock, the grove, that matters. Our responsibility is to species, not specimen; to communities, not to individuals."
—Sara Stein

At sunrise, a member of the Yakima Tribe trudges through Wenatchee National Forest in Washington state. Near the nest of a white-headed woodpecker (*Leuconotopicus albolarvatus*), she measures large-diameter trees and snags—places where the bird likes to lay its eggs. She scribbles measurements on vegetation data sheets printed on write-in-the-rain paper. More volunteers do the same in other nest sites throughout the forest.

In a Forest Service laboratory, a wildlife biologist downloads gigabytes of satellite data on coastal coniferous forests in the Pacific Northwest. Much later, he combines these data with field data in a model to map the nesting habitat of the endangered marbled murrelet (*Brachyramphus marmoratus*).

And, in Oregon, a researcher peers at a digital map on her computer. She tallies the length of roads open to vehicular traffic in the Wallowa-Whitman National Forest and overlays the thousands of locations from elk captured in the forest and outfitted with telemetry collars. Later, she uses the information to evaluate the effects of roads on elk.

Mary Rowland

Habitat monitoring is a cost-effective way to keep a pulse on the ecological conditions needed by at-risk wildlife species. A standardized approach allows monitoring results to be compared over time and among management units. Above, a biological technician samples sagebrush in western Wyoming.

All over the United States, researchers, technicians, and volunteers gather field data and download remote sensing data about wildlife habitat. They read the landscape for clues to tell them if habitats have the right features to provide for healthy wildlife populations.

IN SUMMARY

National forests and grasslands are home to a diverse array of wildlife. To keep tabs on the general viability and well-being of these inhabitants, land managers need practical, defensible monitoring protocols. Population monitoring is one method. Another is habitat monitoring, which provides critical information about the quantity and quality of key habitat attributes and often can be conducted for a lower cost than population monitoring. By using standardized protocols, biologists across jurisdictional boundaries can compare habitat monitoring results over time and among management units.

A new, comprehensive guide meets these needs by describing monitoring principles, standard monitoring protocols and data sources, analysis approaches, and detailed examples for developing comprehensive habitat monitoring programs. The book, titled A Technical Guide for Monitoring Wildlife Habitat, *includes 10 chapters that present the interdisciplinary perspectives of 24 authors, including wildlife, vegetation, and forest ecologists; silviculturists; remote sensing experts; and statisticians. The guide provides detailed steps that can aid Forest Service units in developing land management plans in compliance with the 2012 Forest Service Planning Rule, which emphasizes ecological conditions—that is, habitat—as the basis for monitoring ecological integrity of at-risk species.*

The guide is being put to use by national forests across the West and has been endorsed by the Association of Fish and Wildlife Agencies.

"Habitat is what makes an animal occur, reproduce, and thrive," says Mary Rowland, a research wildlife biologist at the Pacific Northwest Research Station. "It's part of the foundation for the existence of the species."

The U.S. Forest Service has a stake in knowing how forests and grasslands are supporting important species. "The agency manages habitat on over 190 million acres," Rowland says. "In terms of wildlife, the mandate is to provide habitat to support a wide variety of native species, including viable populations for all species of concern."

Rowland is 1 of 24 researchers who recently completed a monumental effort to develop a guide for crafting habitat-monitoring plans. The guide forges a path for harnessing the power of habitat monitoring. The researchers hope it will calibrate and, in a sense, bring together monitoring efforts all over the country.

KEY FINDINGS

- From den sites to home ranges, wildlife use habitat at several scales. Thus, effective habitat monitoring needs to occur at multiple scales of time and space. While broad-scale monitoring reveals general trends in habitat condition, fine-scale monitoring reveals shorter term effects of local management actions.
- A well-designed long-term habitat monitoring program can provide information about the effects of management actions on wildlife habitat and the relations between habitat conditions and population status.
- Habitat monitoring programs need not start from scratch. A wealth of available data is well-suited for habitat monitoring, leading to increased efficiencies, cost savings, and improved coordination across management units.

WHAT TO MONITOR?

From forest thinning, to road building, or weed control, activities on national forests and grasslands are guided by formal land management plans. Under the 2012 Forest Service Planning Rule, plans need to include components designed to provide the ecological conditions (habitat) to keep common species common, contribute to the recovery of threatened and endangered species, conserve candidate and proposed species, and maintain species of conservation concern.

The 2012 Planning Rule also has direction for monitoring to determine if the plan's objectives for habitat conditions are being met.

To comply, land managers develop detailed plans to watch a species' habitat. The monitoring plan describes the species' habitat requirements, and poses specific questions about what land managers need to know for evaluating how management actions might affect habitat. It also details how often data are collected. Repeated measurements can reveal if habitat trends are stable or tipping downward toward a level that would trigger a change in management.

Discussions with stakeholders, from adjacent property owners to nongovernmental organizations, about what species to monitor and what aspects of habitat should be monitored can be valuable and likely reduce or avoid conflict later on. "Having that dialog upfront is very important," Rowland explains.

But in a bigger picture, if different land managers all over the country choose different aspects of a species' habitat to monitor or dif-

Michelle Gerdes

Data on tree age and size help characterize stand conditions as they relate to habitat requirements of forest-dwelling wildlife species. Future measurements can be compared to these baseline data to determine if predefined thresholds for stand conditions have been crossed.

Purpose of PNW Science Findings

To provide scientific information to people who make and influence decisions about managing land.

PNW Science Findings is published monthly by:

Pacific Northwest Research Station
USDA Forest Service
P.O. Box 3890
Portland, Oregon 97208

Send new subscriptions and change of address information to:

pnw_pnwpubs@fs.fed.us

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Science Findings is online at: http://www.fs.fed.us/pnw/publications/scifi.shtml

To receive this publication electronically, change your delivery preference here:

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ferent ways of measuring them, opportunities to find meaningful patterns in the data are lost.

"It's apples and oranges," Rowland explains. "Say one forest monitors habitat for American martens and it counts the number of down logs of a certain size. The forest next door also wants to monitor habitat for martens but it chooses a different attribute. If you're all choosing different metrics, everybody could be out there collecting good data but you can't compare them."

In the mid-2000s, the Washington, DC, office of the Forest Service developed protocols for monitoring populations of selected species and protocols for population monitoring in general. The next step was developing national protocols for habitat monitoring. Christina Vojta, then assistant national wildlife ecologist, invited Rowland to help put together the first comprehensive guide to monitoring wildlife habitats. "Monitoring a species' population is key in understanding its status," Vojta says. "But habitat monitoring is needed to ensure each species has the resources needed for sustainability."

"It was sort of a behemoth to get off the ground, but once we got rolling, we had a fantastic group of scientists and managers to pull it together," Rowland says.

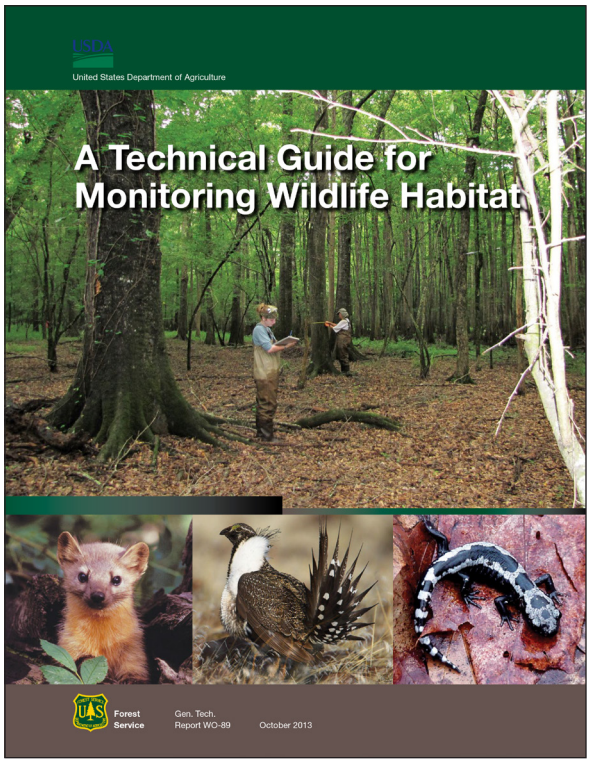
THE GUIDE TO MONITORING WILDLIFE HABITATS

The book, titled *A Technical Guide for Monitoring Wildlife Habitat*, is written for professionals—such as biologists, ecologists, silviculturists, and planners—charged with forest planning, habitat monitoring, and project impacts analysis. It can be used for designing habitat-monitoring plans on ranger districts, for an entire national forest or national grassland, or across a region. The guide is accessible to other federal agencies that need to monitor habitat. "A private landowner can also certainly use the guide," Rowland says.

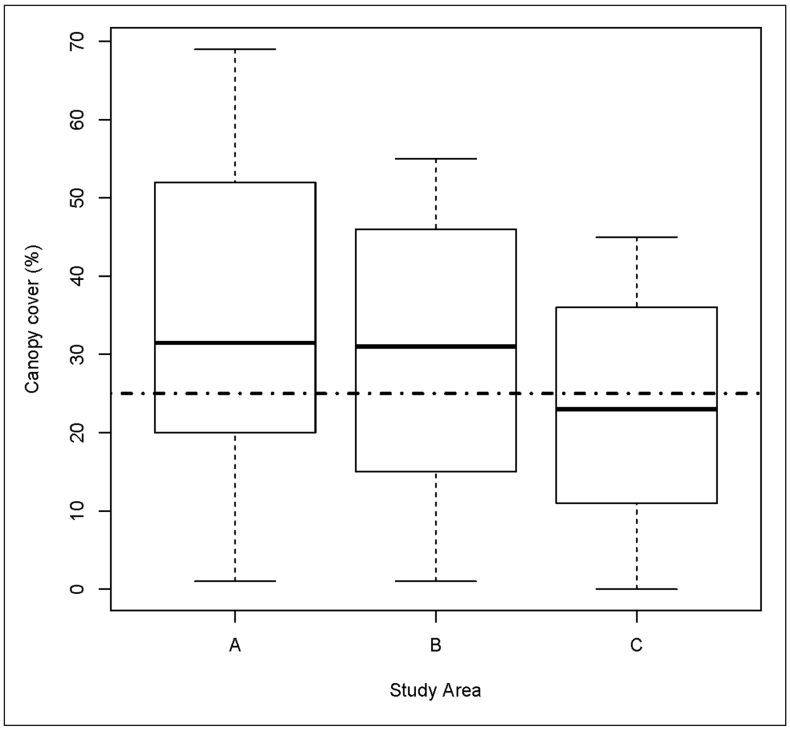
The book leads readers through selecting key habitat attributes to measure. Attributes refer to qualities or aspects of resources that need to be present to support a species. For example, greater sage-grouse (*Centrocercus urophasianus*) need vast swaths of sagebrush to thrive. An attribute for the species could be sagebrush patch size, measured by the acre, in a planning unit. American martens *(Martes americana*) often depend on multiple tree canopy layers, snags, and down wood. So habitat attributes for this species could include tree height, canopy cover, down wood, and snags.

Ten chapters walk a reader through habitat attribute selection, planning and design, data collection, and finally analysis. One chapter also offers recommendations for data management, storage, and reporting. Throughout the guide, authors discuss the scientific underpinnings of monitoring and its application in modern conservation planning. More importantly, the guide offers standard protocols for monitoring habitat attributes at different spatial scales. It also provides methods for evaluating how human disturbance, such as recreation or traffic, can affect an animal's use of habitat.

Land managers can find steps and examples to help tailor their plans to the 2012 Planning Rule. "This guide represents the best available science on habitat monitoring, and it draws from a large base of published literature," Vojta says.



Published in 2013 by the U.S. Forest Service, A Technical Guide for Monitoring Wildlife Habitat *is being used by national forests throughout the West.*



Through monitoring, it is possible to detect when values for a habitat feature fall below a predefined threshold. In this example, the average canopy cover remains above the threshold of 25% (dotted line) in study areas A and B, but has fallen below this value in study area C. Thus, more intensive sampling in that site, or a change in management, is warranted.

It took about 4 years for Rowland, Vojta, and their colleagues to finish the guide. "Through the years of working on the project, a few things stood out," Rowland says.

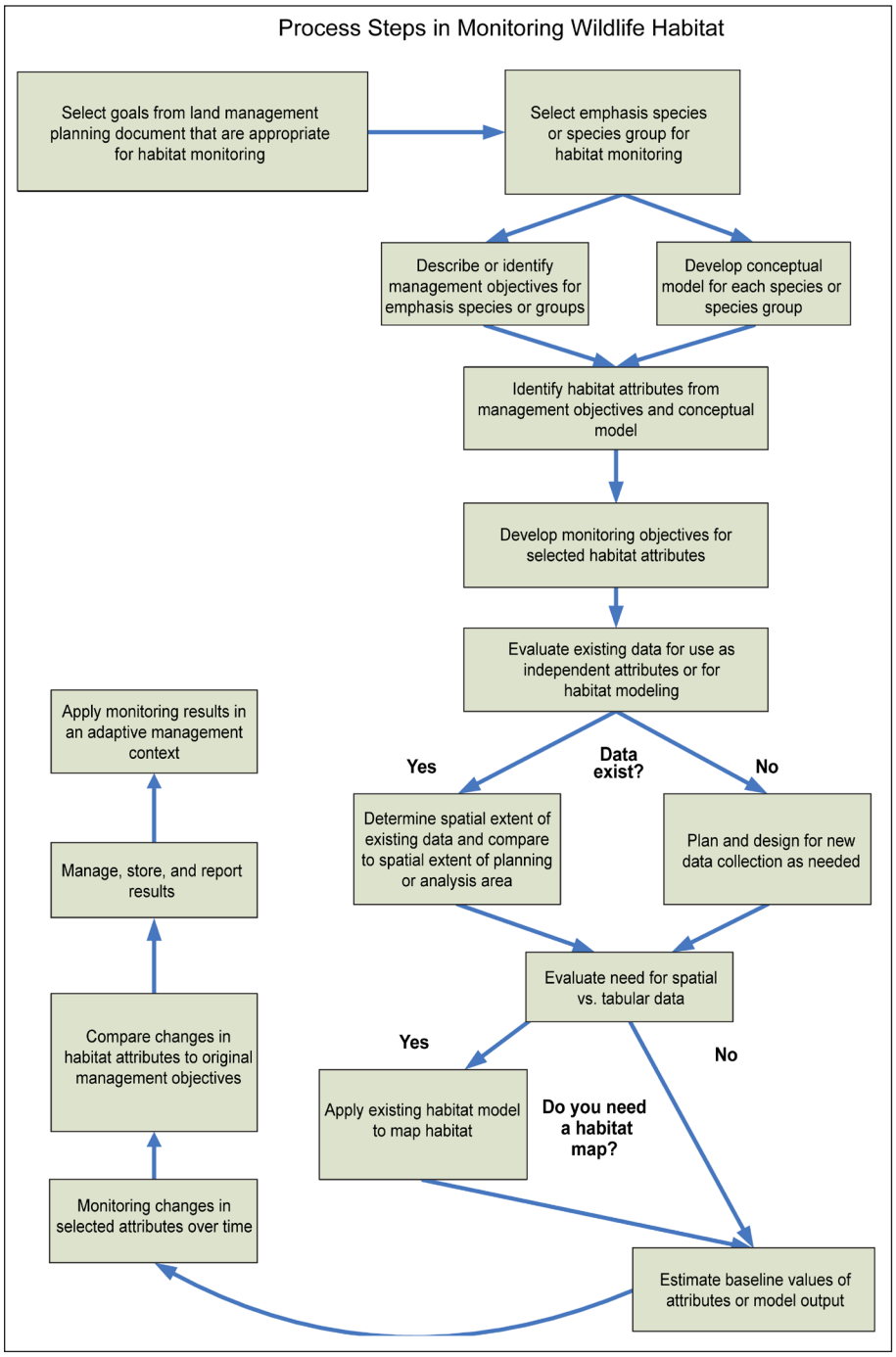
They realized that to be effective, habitat-monitoring plans had to cover multiple spatial scales, from fine scale, or small areas, to broad scale, or larger areas. "Most species have habitat needs across a range of spatial scales, from den sites to foraging areas to home ranges," Rowland says. "So you need to capture or measure habitat attributes at scales meaningful to the selected species."

Broad-scale monitoring can reveal trends in habitat conditions that are relevant to the presence of the species across a large area, whereas fine-scale monitoring can reveal the effects of local management actions, such as prescribed fire, on the availability of nesting or foraging sites.

For example, at the broad scale, greater sage-grouse need large areas dominated by sage-brush. Without it, the birds are unlikely to be found. At this scale, land managers could monitor the percentage of the landscape in sagebrush at some minimum canopy cover, or connectivity between large patches of sage-brush. At the fine scale, sage-grouse hens and their chicks need early brood-rearing habitat with abundant forbs—herbaceous flowering plants such as common dandelion (*Taraxacum officinale*) and clover (*Trifolium* spp.)—for forage. Land managers monitor forb abundance and height in these important habitats.

The researchers also found a wealth of available data that land managers can readily incorporate into their habitat monitoring plans. Many wildlife habitat attributes, such as tree canopy complexity and snag density, can be derived from data collected by the national Forest Inventory and Analysis (FIA) program of the Forest Service. The FIA program serves as the Nation's forest census, and data have been collected since the 1930s. The data are housed in easily accessible online databases.

"Remote sensing is another type of data that is becoming more and more available," Rowland says. "Most satellite data are free, and it is increasingly expensive to send crews out to collect field data." The guide introduces remote sensing methods for a variety of vegetation monitoring needs. Remotely sensed metrics include greenness indices, land cover change, and fine-scale canopy cover.



Rowland, M.M., et al. 2013

A careful, stepwise process for developing a habitat monitoring program is paramount to its success. This chart can be found in chapter 10 of the guide.

USING THE GUIDE

Kim Mellen-McLean, regional wildlife ecologist for the Pacific Northwest Region, had never designed a habitat monitoring effort for a large region. But she was tasked with putting together a 6-year plan for monitoring white-headed woodpeckers in Oregon and Washington.

"It's a sensitive species and studies out of central Oregon indicated the reproductive rate was low," Mellen-McLean says.

Mellen-McLean recognized the challenges of developing a well-designed habitat-monitoring program and so turned to the guide for ideas.

"It helped us think about the questions we were trying to answer," she says.

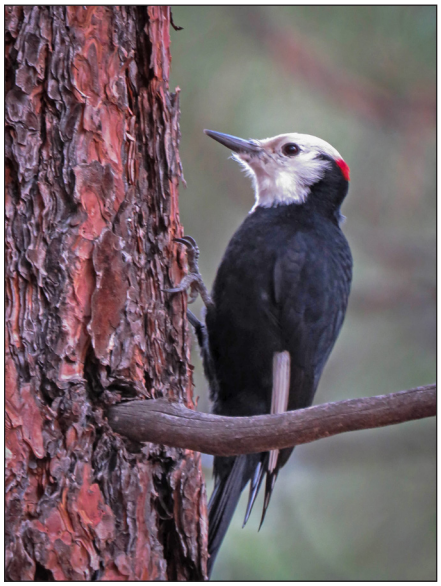
Mellen-McLean found the checklist for developing a habitat-monitoring program in chapter 10 particularly useful. It outlined everything her team had to do. And, at the end of chapter

10, there were three examples or case studies developed using the checklist: one for the greater sage-grouse, another for the American marten, and one for mole salamanders (family Ambystomatidae).

As she developed the field sampling and statistical design in cooperation with Vicki Saab at the Rocky Mountain Research Station, Mellen-McLean relied heavily on the rest of the chapters in the guide. "I wanted to have our protocol follow the outline and the strategies they proposed in the guide," she says. "I thought it was more likely to be supported by the agency and made sure we considered everything we needed to consider."

Mellen-McLean and Saab designed one of the most comprehensive wildlife monitoring strategies developed yet for the white-headed woodpecker, a regional endemic of the western United States and Canada. As part of the strategy, wildlife managers evaluate habitat suitability for nesting woodpeckers in burned and unburned forests and determine historical and future nesting habitats under different climate and management scenarios.

"Before land managers spend a lot of money on a monitoring protocol, strategy, or approach, they should get a hold of the guide and take a look at it," Mellen-McLean says. "Read through it, because it gives you a lot of food for thought and a good outline of what a monitoring strategy should contain."



Skip Russell (flickr.com/skipr)

Mature ponderosa pine forests are key habitat for the white-headed woodpecker, a species with limited distribution and narrow habitat requirements.

LAND MANAGEMENT IMPLICATIONS

- The guide provides detailed steps and examples that can aid Forest Service units in developing land management plans according to the Forest Service 2012 Planning Rule, which emphasizes ecological conditions—or habitat—as the basis for monitoring ecological integrity and at-risk species.
- Long-term habitat monitoring provides a foundation for meeting legal, social, economic, and multiple-use needs. Gathering consistent information over time allows habitat trends to emerge that might otherwise remain hidden, and can point to needed course corrections in management.
- Developing a habitat monitoring program facilitates valuable dialog between stakeholders and managers, ensuring that use of monitoring data in management is transparent and well-justified.

CITIZEN SCIENTISTS

Other organizations have also come to depend on the guide for developing their habitat monitoring plans. The Association of Fish and Wildlife Agencies, an organization representing state natural resource agencies across North America, encourages its members to use the guide in developing State Wildlife Action Plans. These plans, developed by all 50 states, assess the health of each state's wildlife and habitats. An independent science review of the national forests of the Sierra Nevada also relied on the guide in its recommendations for bioregional monitoring of species and habitats in this area.

Finally, the researchers are optimistic that the guide will allow land managers to work with more efficiently with citizen scientists—visitors to the national forests who volunteer to record data while afield. Rowland says citizen scientists have contributed valuable population data by recording the whereabouts and numbers of popular taxa such as birds and butterflies. But similar volunteer programs in habitat monitoring are still uncommon.

With a bit of creativity, Rowland says land managers can use techniques described in the guide to get citizen scientists to collect good habitat data. For example, volunteers can use their smart phones and tablets to upload habitat data for storage in cloud-based programs. As funding to manage and monitor wildlife habitat becomes scarce, these volunteers could play more important roles in habitat monitoring. With more eyes and ears out in the forest, they could help bolster habitat-monitoring programs all over the country.

"The care of the earth is our most ancient and worthy and, after all, our most pleasing responsibility. To cherish what remains of it, and to foster its renewal, is our only legitimate hope."

—Wendel Berry, *The Art of the Commonplace: The Agrarian Essays*

FOR FURTHER READING

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