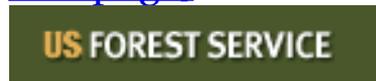


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## » Fish and Wildlife

Highlights in 2014

- [New technical guide offers comprehensive guidance for wildlife habitat monitoring on public lands in the United States. It has been endorsed in the science review of bioregional monitoring for national forests in the Sierra Nevada and by the Association of Fish and Wildlife Agencies for state wildlife action plans.](#)
- [Scientists project the effects of climate change on ecosystems and wildlife habitats in northwest Alaska. Projections indicate increases in some ecosystems and decreases in others and associated changes in dependent birds and mammals. Declines will occur in half of the 50 bird and mammal species currently used for subsistence hunting and trapping.](#)
- [Offshore abundance of marbled murrelets is most](#)

Podcast



[Podcast PNW Ecotone](#)



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[strongly associated with amount and pattern of adjacent suitable forest nesting habitat. Prior to this study, it was unclear if abundance of this threatened species was more heavily influenced by nesting habitat or by availability of forage in nearshore marine waters.](#)

- [The salmonid species \*Oncorhynchus mykiss\* can become seagoing steelhead or freshwater rainbow trout. Lipid accumulation and metabolic rate appear to influence which life history young \*O. mykiss\* will assume.](#)

As a steward of public lands, the Forest Service works to enhance and restore habitat for the wildlife and fish that live in national forests and grasslands and the waterways that flow through these lands.

Station scientists provide tools and knowledge that land managers and decisionmakers can use to minimize the effects of fire, urbanization, disease, and climate change on habitat.

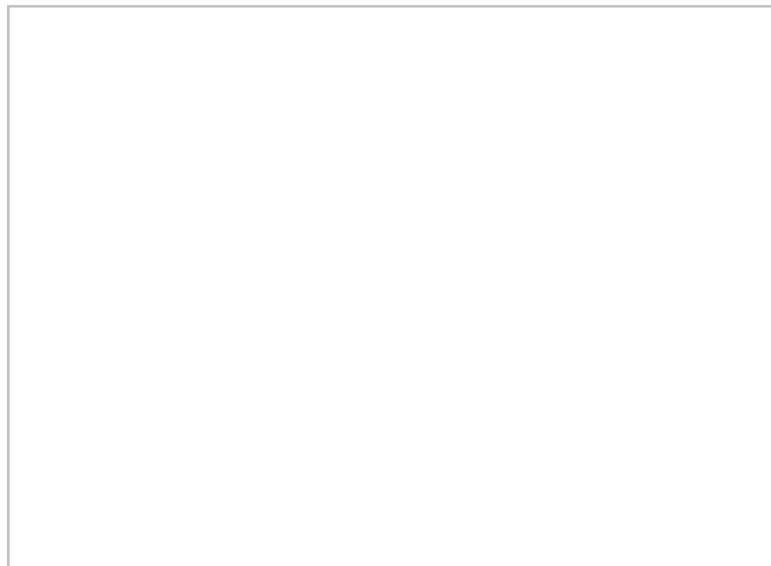
**Pacific Northwest Research Station**

1220 SW 3rd Ave.  
Portland, OR 97204

(503) 808-2100



National technical guide provides a foundation for monitoring wildlife habitat on national forests



A new technical guide provides standardized protocols for habitat monitoring. The American marten (above) is one of the species featured as a case example for habitat monitoring. Photo by Michael Mengak, Univ. of Georgia, Bugwood.org.

Endorsed by Association of Fish and Wildlife Agencies for use in state wildlife action plans.

Information about the status and trends of wildlife habitat is fundamental for meeting the mission and legal and policy requirements of the Forest Service. Many techniques have been used to monitor wildlife habitat in the Forest Service, but no comprehensive guide existed to provide standardized protocols for habitat monitoring. To that end, working with partners, Forest Service scientists and managers from three research stations, eight regions, and the Washington office published a national, multichaptered book. This technical guide provides current, scientifically credible, and practical protocols to inventory and monitor terrestrial wildlife habitat. It is written for resource professionals (e.g., ecologists, silviculturists, and planners) charged with forest planning, project impacts analysis, and habitat monitoring at ranger district, national forest or grassland, and regional levels. The book also offers guidance to other agencies and organizations in the use of standardized, contemporary approaches for wildlife habitat monitoring.

**Contact:** [Mary Rowland](#)

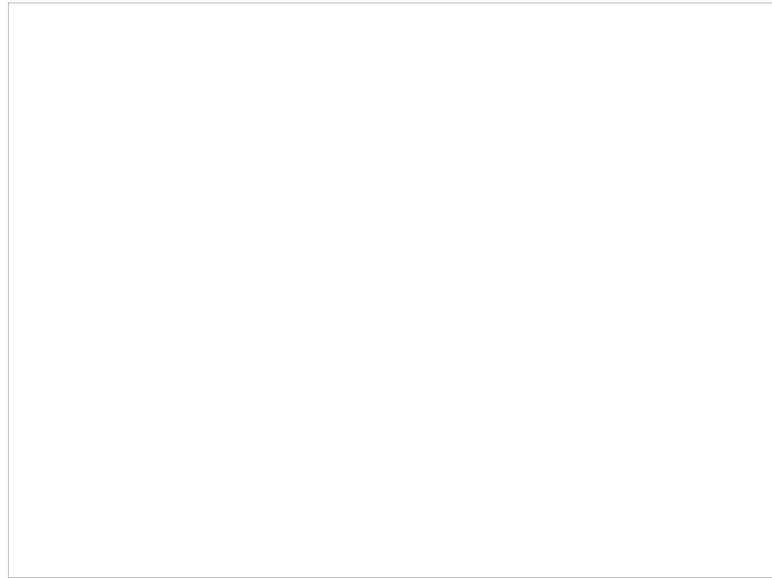
**Partners:** USDA Forest Service, Northern Research Station, Rocky Mountain Research Station; Washington office, Terrestrial Wildlife Ecology Unit and Ecosystem Management Coordination; Forest Service Regions 1, 2, 3, 4, 6, 8, 9, and 10; Forest Inventory and Analysis; Remote Sensing Applications Center; University of Massachusetts; and Western Ecosystems Technology, Inc.

**Citation:** [Rowland, M.M.; Vojta, C.D. tech. eds. 2013.](#) A technical guide for monitoring wildlife habitat. Gen. Tech. Rep. WO-GTR-89. Washington, DC: U.S. Department of Agriculture, Forest Service. 400 p. <http://www.treearch.fs.fed.us/pubs/45213>.

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Projecting the effects of climate change on ecosystems and wildlife habitats in northwest Alaska

Declines projected for 25 bird and mammal species currently used for subsistence.



Climate-induced habitat changes will affect birds and other wildlife in northwest Alaska. Melting permafrost, for example, can cause tundra lakes to drain. Some species will likely benefit from these changes, while others will not. Photo by Bruce Marcot.

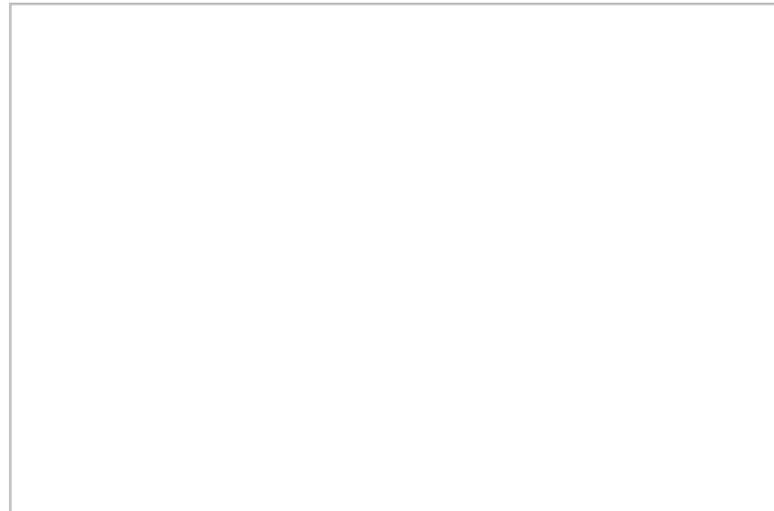
Climate change is affecting terrestrial and aquatic ecosystems and associated wildlife habitats in the arctic and subarctic more rapidly than anywhere else. Such changes are likely to reduce snow-based access to areas used for hunting and trapping and alter the abundance and availability of wildlife, including species used for subsistence by native Alaskans and local communities. To project the effects of such changes over the 21st century in northwest Alaska, scientists developed a set of state-transition models and wildlife-habitat relationship models that summarize knowledge on the extent and transitions of ecosystems and wildlife habitats and their biophysical drivers.

Projections indicate habitat increases in some ecosystems and decreases in others, with associated changes in dependent birds and mammals. Expansion of tall shrubs and trees, increase in fire, vegetation succession, and melting of permafrost are some of the major disturbances that will drive the transitions. Of the 201 bird and mammal species currently occurring in the area, the model projects that 52 percent will experience habitat expansion, 45 percent will see habitat contractions, and only 3 percent will have no change. Declines will occur in half of the 50 bird and

mammal species currently used for subsistence hunting and trapping. These results were shared with federal agencies in the region and presented at public conferences and information sessions for local communities.

Contact: [Bruce G. Marcot](#)

Partners: USDI Geological Survey and National Park Service



Nesting habitat for the sea-going marbled murrelet is critical to its conservation. Photo by Nick Hatch.

**Offshore abundance of marbled murrelets is most strongly associated with amount and pattern of adjacent suitable forest nesting habitat**

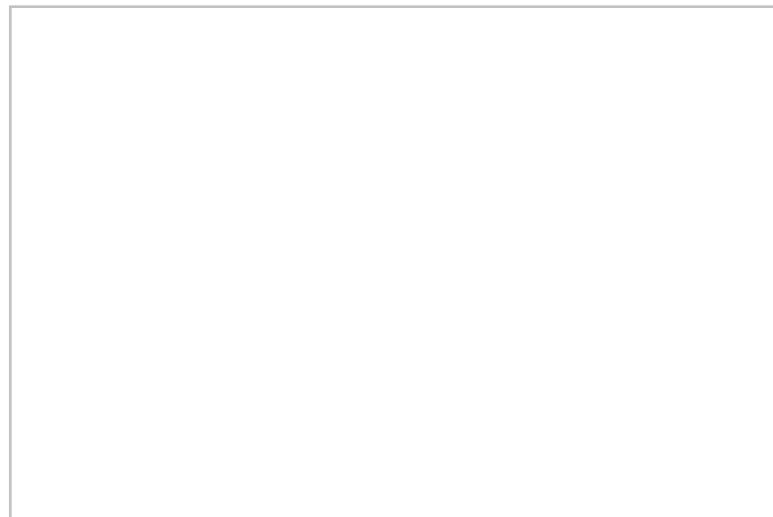
The marbled murrelet is a threatened species of seabird that forages on small fish and invertebrates in nearshore marine waters, and nests inland on limbs of large coniferous trees. A major objective of the Northwest Forest Plan is to conserve the bird's nesting habitat. However, because the bird forages in ocean waters, managers have not been certain if conservation of nesting habitat is key to the species conservation or if marine factors that influence the bird's prey are more important.

Scientists developed a model that evaluates the relative contributions of a set of marine variables and nesting habitat variables. They found that the nesting habitat variables were the strongest contributor to predictions of murrelet abundance, which means that conservation of nesting habitat appears essential to conservation of murrelet populations.

This work has been immediately applied by U.S. Fish and Wildlife Service managers who are tasked with consulting on projects that may harm marbled murrelets. It has also been applied by Forest Service and U.S. Fish and Wildlife Service managers in setting policy for management of nesting habitat within the range of the murrelet. The work also has informed the marbled murrelet effectiveness monitoring group about the relevance of habitat monitoring in assessing effectiveness of the Northwest Forest Plan.

**Contact:** [Martin G. Raphael](#)

**Partners:** California Department of Fish and Wildlife, Oregon Department of Forestry, U.S. Fish and Wildlife Service, USDI Bureau of Land Management, Washington Department of Natural Resources



Rainbow  
trout or steelhead? A novel study begins to unravel how the life-history expression of *Oncorhynchus mykiss* relates to habitat, water temperature, sex, metabolic rates, and lipid levels. Photo by Mark Lisac, U.S. Fish

and Wildlife Service.

Lipid accumulation and metabolic rate influence steelhead vs. rainbow trout life history

Lipid levels decrease at higher temperatures; fish with lower lipid levels tended to be female steelhead.

Protecting and restoring freshwater habitats for steelhead in the face of potential climate change impacts is a major challenge. Many populations of steelhead are protected by the Endangered Species Act. Steelhead are the seagoing form of *Oncorhynchus mykiss*, whereas rainbow trout (also *O. mykiss*), reside lifelong in freshwater. The offspring of either form may opt for the opposite life history, but the mechanisms for this are not well understood.

Five coordinated, independent studies addressed aspects of how life-history expression relates to habitat, water temperature, sex, metabolic rates, and lipid levels. To conduct this research, the scientists used a novel, nonlethal method for genetically determining the sex of salmon smolts.

Scientists found that steelhead spawn in areas that contain both suitable spawning gravels and nearby juvenile rearing habitat. Lipid accumulation was related to metabolic rate and life history: fish with lower metabolic rates and higher lipid levels tended to be rainbows. Lipid levels decreased at higher temperatures, and fish with lower lipid levels tended to be steelhead and female. In fact, 70 percent of steelhead were female. This was true for 65 to 70 percent of steelhead smolts from northern California to southeast Alaska to central Idaho.

This work makes a major contribution to understanding the life-history expression in *O. mykiss* and other species that exhibit similar variation in life histories. It provides insight for the variation in life-history expression between sexes and challenges the notion that faster growing fish tend to be sea-going steelhead.

**Contact:** [Gordon Reeves](#)

**Partners:** National Oceanic and Atmospheric

## In-stream habitat restoration benefits Chinook salmon and steelhead trout

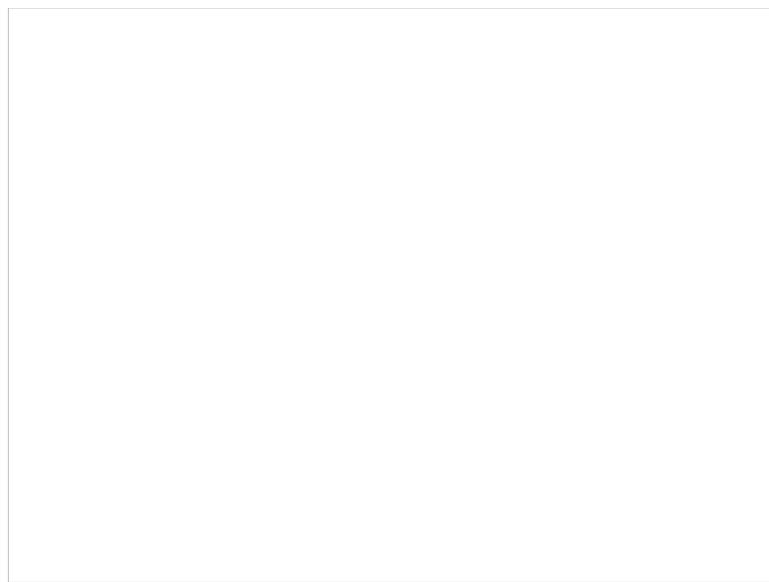
Station scientists and cooperators evaluated the effectiveness of in-stream habitat restoration structures to enhance rearing habitat for juvenile salmonids for a fifth study year (2009–2013). Habitat restoration structures consisted of engineered logjams and rock barbs extending from banks of streams in the Entiat River watershed of the upper Columbia River basin. More Chinook salmon continue to be found in microhabitats with restoration structures compared to those without restoration structures early in the season. Deeper water around restoration structures appears to be the mechanism leading to increased Chinook salmon abundance. Steelhead trout were much more variable in their use of restored vs. unrestored microhabitats.

These results are being used by restoration planners and by a larger monitoring program to further inform the design and implementation of additional restoration structures in the same watershed and in other watersheds throughout the upper Columbia River basin.

**Contact:** [Karl Polivka](#)

**Partners:** Cascadia Conservation District, Integrated Status and Effectiveness Monitoring Program, National Oceanic and Atmospheric Administration—Fisheries, U.S. Bureau of Reclamation

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Adding down wood to riparian areas following timber harvest helps create moist microhabitats favored by red-backed salamanders. Photo by Martin Raphael.

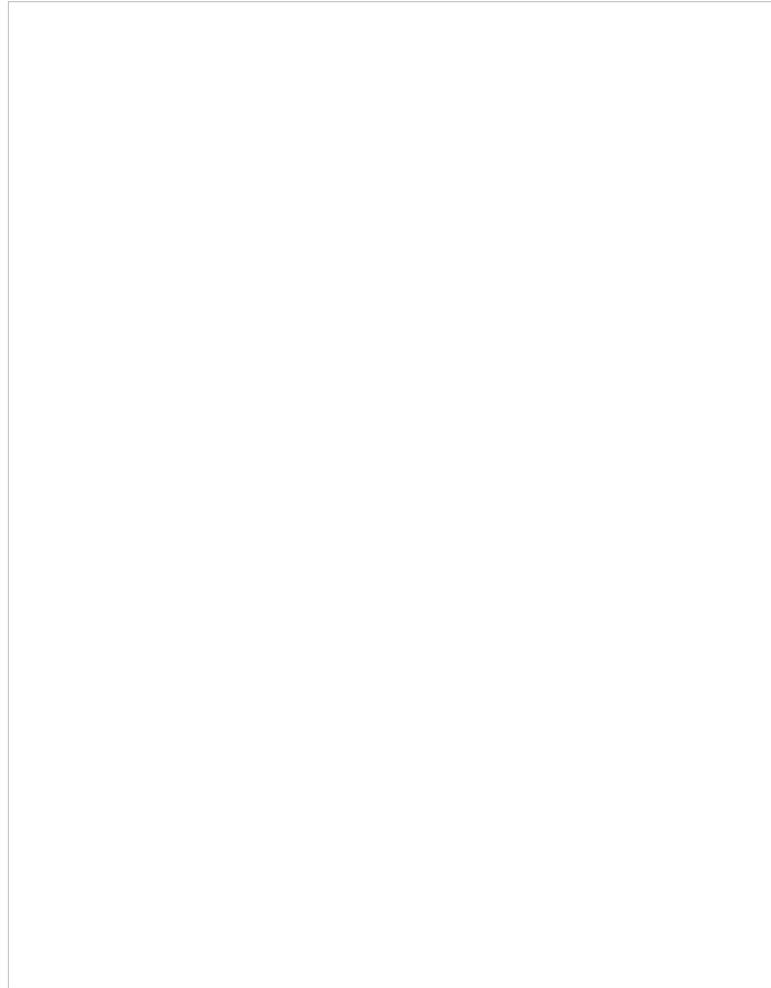
Salamander benefits from large amounts of wood debris along headwater streams following clearcutting

Woodland salamanders may be used to monitor biodiversity and ecosystem integrity following forest disturbance. As part of a study of alternative riparian buffer treatments along headwater streams, scientists trapped western red-backed salamanders (*Plethodon vehiculum*) before and after treatments to determine treatment effects. Their goal was to learn how alternative buffering strategies could be used to conserve and protect headwater streams during timber harvest.

They found that the reduced forest canopy caused by clearcut harvest and partial clearcut harvest (forest islands on fragile sites in a clearcut landscape) had detrimental effects on moist micro-environments used by salamanders.

Retaining dead downwood plus adding three to six times more dead downwood than occurred before harvest to create moist microenvironments seemed to lessen the expected adverse treatment effects on salamanders in clearcut areas.

**Contact:** [Martin G. Raphael](#)



The Meadow Creek restoration project at the Starkey Experimental Forest and Range is examining how browsing by native and domestic ungulates such as cattle, elk, and mule deer affects riparian vegetation and subsequently stream water temperatures, native pollinators, small mammal populations, and more. The findings will be used to design best ungulate management practices to improve riparian systems. Photo by Rhonda Mazza.

An innovative, multidisciplinary riparian restoration project

Federal agencies have spent millions of dollars restoring streams and riparian habitats to recover endangered salmonids, including placement of woody debris and planting native shrubs and trees to stabilize banks and mediate stream temperatures. Small mammals, birds, and native pollinators may also benefit from stream restoration. However, browsing by native and domestic ungulates such as cattle, elk, and mule deer can

dramatically affect riparian vegetation, even eliminating key species such as willows.

Knowledge about effects of cattle versus deer/elk herbivory on shrub recovery is limited, posing major obstacles in designing best ungulate management practices to improve riparian systems for salmonids. Moreover, knowledge is limited about effects of climate change on stream temperature, and how these effects may be ameliorated by restoration plantings. To address these complex and important issues, the PNW Research Station initiated a long-term research project at Meadow Creek within the Starkey Experimental Forest and Range.

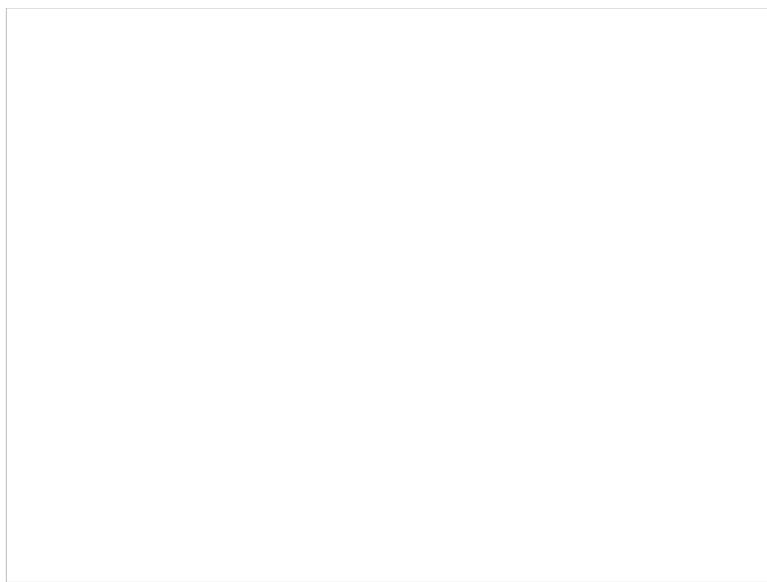
This project offers novel opportunities for cross-cutting research to understand links between abiotic and biotic systems in arid environments. The integrative approach addresses holistic management of complex riparian ecosystems and their multiple stressors. The Meadow Creek restoration project will result in a comprehensive set of best management practices for recovery of riparian systems that include effective ungulate management in the intermountain West.

**Contact:** [Michael Wisdom](#)

**Partners:** Bonneville Power Administration; Columbia River Intertribal Fish Commission; Grande Ronde Model Watershed; Oregon Department of Fish and Wildlife; Oregon State University; USDA Forest Service Pacific Northwest Region, Wallowa-Whitman National Forest

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Terrestrial salamanders in managed forest headwater basins move nearer to streams



Artificial

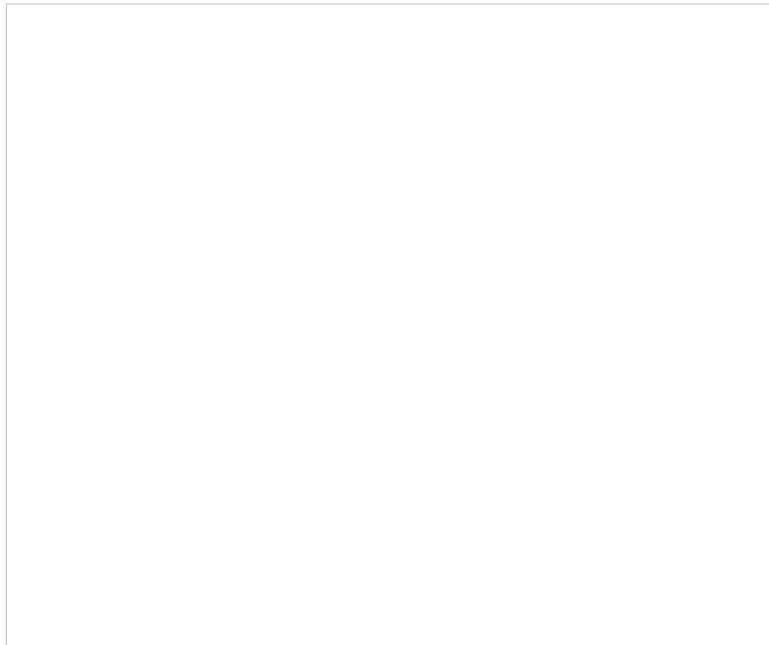
covers, such as boards, facilitate the study of salamander movements at this study site in the Oregon Coast Range. Photo by Matt Kluber.

Station scientists examined terrestrial salamanders in managed headwater forest stands in western Oregon from 1998 to 2009. They found that headwater riparian areas may act as habitat “funnels” for these animals, where movements are concentrated within and along narrow streamside zones.

The scientists provide options for where and how to enhance ground surface habitat connectivity for sensitive salamander species in forests in the west Cascades. Positioning upland down wood in “chains” extending out from riparian area funnels may facilitate overland habitat connectivity for salamander dispersal. At larger spatial scales, landscape chains of connectivity may be designed with log links connecting riparian and upland areas. This work may inform riparian forest management and riparian-upland management decisions.

Contact: [Dede Olson](#)

Partner: Oregon State University



The Malone jumping-slug (*Hemphillia malonei*) is one of seven species of jumping-slugs found in the Pacific Northwest. Photo by Robin Shoal.

## Terrestrial mollusks respond to logging in riparian areas

Little is known about the biology and response to environmental change of native, terrestrial mollusks in the Pacific Northwest. Most people simply regard slugs and snails as garden pests, but most often the actual culprits are introduced nonnative species. Because of mollusk affinities to moist environments, the effect of human-caused habitat alteration from logging is assumed to be detrimental but is largely unknown. This uncertainty is problematic because federal agencies are required to account for impacts to sensitive, native mollusks as part of their project environmental analyses. Several mollusk species are being considered for protection under the Endangered Species Act.

Station scientists evaluated the response of terrestrial mollusks within three different buffer configurations along small streams in western Washington. The buffers consisted of 30-meterwide fixed-width corridors, clearcuts with no buffers, and unlogged controls. Mollusks were sampled both before and after logging.

The scientists found that mollusk communities varied among sites relative to vegetative composition, the amount of understory cover, and the presence of seeps or small wetland features in the riparian areas. After

logging, slug and snail abundance were significantly different between streams with no buffers and control streams. Mollusk abundance differed significantly between fixed-width buffers and streams with no buffers. The effect was relatively small, however, suggesting that site variability may override the effects of logging. These findings illustrate that site differences can affect mollusk community structure and influence resiliency to disturbances such as logging. This research contributes to our understanding of a little-studied but important component of Pacific Northwest forest biodiversity.

**Contact:** [Alex Foster](#)

**Partners:** University of Washington, USDA Forest Service Olympic National Forest, Washington Department of Natural Resources

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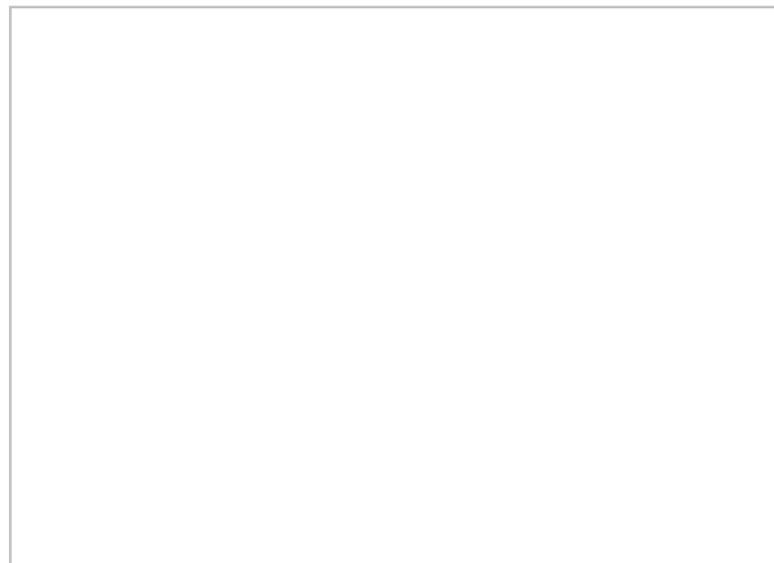
Conservation assessments and maps for regionally sensitive species

Scientists compiled comprehensive summaries of the biology and ecology of two regionally sensitive salamanders: Cope's giant salamander and Van Dyke's salamander. Natural resource managers use species conservation assessments to develop science-based management alternatives when they have a proposed land-use action within the range of a state or federally listed species. The Interagency Special Status and Sensitive Species Program for the Forest Service and Bureau of Land Management notifies regional agency biologists about the availability of these conversation assessments.

Scientists also mapped two sensitive turtle species in the region: the western pond turtle and painted turtle.

This is the first publication to compile locations across the United States and Canada. It included maps of known locations by date, demonstrating accrual of knowledge and showing where re-surveys may be needed to learn if the species are still present at historical sites. Natural resource managers use these types of locality maps of species sites for status assessments. Gaps in locations may be used to target geographic areas for new surveys, whereas known locations may be useful for development of monitoring programs.

**Contact:** [Dede Olson](#)



Pygmy rabbits, an endangered species in Washington state, selectively browse on sagebrush plants with higher levels of crude protein. Photo by Boise State University.

Pygmy rabbits use nutritional and chemical cues while making foraging decisions

Pygmy rabbits are dietary specialists that feed on sagebrush and forage on specific plants more than others within a foraging patch. These small rabbits are endangered in Washington state and considered a sensitive species throughout the Great Basin.

For herbivores, nutrient intake is limited by the relatively low nutritional quality of plants and their high concentrations of potentially toxic defensive compounds, referred to as plant secondary metabolites. Scientists hypothesized that plants with evidence of heavy browsing by pygmy rabbits would have higher dietary quality than plants that were not browsed.

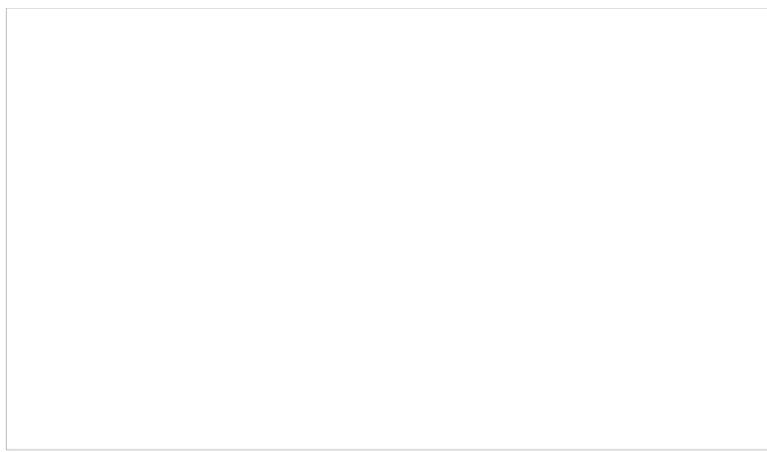
They found that sagebrush plants containing higher crude protein had greater odds of being browsed by pygmy rabbits than plants with lower protein, whereas the opposite was observed for certain secondary metabolites. The scientists concluded that pygmy rabbits use nutritional and chemical cues while making foraging decisions. These rabbits can occupy foraging patches near their burrows for multiple years, and their constant browsing may influence the nutritional and secondary metabolite constituents of these plants. This indicates that dietary quality of the landscape is an important parameter to consider when planning and implementing conservation and restoration strategies for pygmy rabbit habitat.

**Contact:** [Rick Kelsey](#)

**Partners:** Boise State University, University of Alaska, University of Idaho, Washington State University

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Panel evaluates techniques to control raptors preying on western snowy plovers



Pink salmon in the Tye River, Washington. Photo by Jon Dickey.

Plover monitoring refined based on panel's suggestions.

Raptors, particularly northern harriers and great horned owls, prey on western snowy plovers—a federally threatened seabird that lives along the Pacific coast. A seven-member expert panel reviewed the feasibility and efficacy of 26 humane raptor-control techniques. The panel also identified information and monitoring methods to help inform raptor control management as well as extenuating considerations for policy application such as cost consideration, training personnel, workloads, and information management.

The raptor control techniques identified with the highest potential feasibility and effectiveness included lethal removal, and use of various trapping methods, including a cube trap, a Swedish style goshawk trap, and a dho-gaza net trap. The panel also identified a need for monitoring plover nest sites with cameras and observers.

The U.S. Fish and Wildlife Service is applying these findings at designated western snowy plover recovery sites along the Oregon coast. The findings have also been shared with the U.S. Forest Service and Bureau of Land Management for use at their sites. To date, several instances of potential raptor predation have been thwarted by using the identified techniques, and plover monitoring is being refined based on the panel's suggestions.

**Contact:** [Bruce G. Marcot](#)

## Using LiDAR to evaluate habitat characteristics for the red-cockaded woodpecker

The red-cockaded woodpecker is a federally endangered forest-dwelling bird that occupies a narrow ecological niche in southern pine forests. The recovery plan for the woodpecker describes specific habitat requirements to sustain existing populations and facilitate population expansion.

Current efforts to characterize habitats involve labor-intensive installation and measurement of field plots. This research showed that LiDAR data collected by an airborne laser scanner can be used to describe vegetation structure, specific size classes of trees, and spatial arrangement across large land areas while maintaining high spatial resolution. Scientists combined the LiDAR data with data measured on forest inventory plots to develop layers describing specific attributes for softwood and hardwood vegetation. This allowed them to evaluate habitat conditions for the red-cockaded woodpecker using the guidelines specified in the recovery plan.

This method provides an alternative to the plot-based methods currently used to assess and report habitat conditions. The method also allows spatially explicit mapping of forest conditions over large land areas, allowing managers to identify areas where vegetation management could transform existing conditions into those more suitable for the woodpecker.

**Contact:** [Robert J. McGaughey](#)

**Partners:** Department of Energy Savannah River Site,

## New tool: A self-adjusting, expandable telemetry collar for elk



An expandable elk collar, invented at Starkey Experimental Forest and Range, allows researchers to more easily monitor individual elk. Photo by Brian Dick.

Forest Service scientists at the Starkey Experimental Forest and Range in eastern Oregon collaborated with the Oregon Department of Fish and Wildlife to successfully develop and deploy a novel expandable telemetry collar for male elk. The collar is safe, humane, and effective in collecting location and survival data for research and management of wild male cervids (deer and elk).

Successful placement of telemetry collars on male deer and elk has been extremely challenging because their neck size can increase substantially during the rut, and their bodies grow substantially as they mature. The new expandable collar is used on yearling or adult male elk for telemetry tracking of animal locations and Pink salmon in the Tye River, Washington. survival estimation. The majority of collars were successfully worn by elk over a 1- to 3-year period. No deaths or injuries were attributed to the collars, and recaptured

animals were in excellent health after wearing the collars for long periods.

This new technology represents a breakthrough opportunity to gain desired knowledge on ecology of male cervids throughout the world, which has been difficult in the past. Use of the expandable collar technology will allow implementation of important new lines of research needed to address long-standing knowledge voids of keen interest regarding ecology and management of male deer and elk.

**Contact:** [Brian Dick](#), or [Michael Wisdom](#)

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Behavior and nutritional condition buffer elk against direct and indirect effects of climate

Changes in net energy balance strongly influence animal fitness; thus natural selection should favor behaviors that buffer individual animals against negative effects of environmental variation. However, little is known about how energy balances in animals are affected by climate, animal condition, and behavior.

Scientists studied elk in two contrasting ecosystems—montane forest at the Starkey Experimental Forest and Range in eastern Oregon and an arid high desert in Idaho—to test the hypothesis that elk behavior from spring to autumn varies as a function of contrasting climates and by the nutritional condition of individual elk. In the high desert, elk selected sites that required less energy for them to maintain body temperature rather than areas with the highest quality forage. By contrast, elk at Starkey selected sites that provided high-quality forage even if they had to expend more energy in thermoregulation. At the Starkey sites, the nutritional condition of an individual elk did not affect its foraging-site selection. In the desert, however, elk in poorest condition at winter's end strongly selected

areas that reduced thermoregulatory costs during summer.

This study highlights the importance of understanding the roles of animal behavior and nutritional condition in buffering individuals against effects of climate. As climate warms in areas occupied by elk, managers can use this information to balance habitat management for sites that reduce thermoregulatory costs vs. those that provide high-quality forage.

**Contact:** [Mary Rowland](#), or [Michael Wisdom](#)

**Partners:** Idaho State University, Princeton University, University of Idaho, University of Wisconsin–Madison, Wyoming Cooperative Fish and Wildlife Research Unit

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Co-mingling of cattle and elk may facilitate disease transmission between the two species



Although their meetings are infrequent, range cattle and elk do co-mingle for periods long enough to possibly transmit disease from one species to the other. Photo by Rhonda Mazza.

The potential for disease transmission between wild and domestic ungulates is increasing throughout the world, with substantial economic and ecological

ramifications. Estimating the probability of disease transmission on ranges co-occupied by wild and domestic ungulates, however, is notoriously difficult. The first step for estimating the potential for between-species disease transmission is to quantify the proximity between individuals of different species in space and time.

Station scientists and partners assessed the likelihood of disease transmission between domestic and wild ungulates by using longterm location data on cattle, elk, and mule deer collected at the PNW Research Station's Starkey Experimental Forest and Range. They used novel statistical methods to estimate the frequency at which domestic and wild ungulates, tracked with global positioning system collars, would occur in proximity sufficiently close for disease transmission to potentially occur.

The scientists found that elk and cattle had rare co-mingling events, but when the two species did meet, they were closer to each other than expected, based on general space use by these species. This pattern also held for deer and elk, but not for deer and cattle. Understanding the causes for such events is important for designing grazing practices that minimize wild ungulate–livestock contacts. Co-mingling between domestic and wild ungulates, although rare, may facilitate disease transmission. This is a critical issue across the world where cooccupied ranges are common.

**Contact:** [Mary Rowland](#), or [Michael Wisdom](#)

**Partners:** Oregon Department of Fish and Wildlife, University of Calgary, University of California, University of Wyoming

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TOOLS

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FrogLog— Global Bd

## mapping project

### Description:

This publication provides a comprehensive summary of the known occurrence of the amphibian chytrid fungus, *Batrachochytrium dendrobatitis* (Bd), as of June 2014.

### Use:

Global natural resource managers, scientists, and conservationists use locality maps of Bd sites for amphibian species threat assessments, to make local decisions for Bd inventory and monitoring, and to develop study plans for new investigations of Bd ecology and epidemiology and Bd-host interactions. The synthesis is used by biologists and naturalists to gain knowledge of the pathogen and infected amphibian species. The U.S. watershed-scale maps are used to make informed decisions about water draws and use of pathogen disinfection protocols for firefighting and other

land management  
practices.

#### Distribution:

Froglog is internationally distributed via the Internet and email listservers. U.S. watershed maps were distributed to all Forest Service regions in the Western United States and Bureau of Land Management/ Oregon upon request from the agencies.

#### How to get it:

<http://www.fs.fed.us/pnw/lwm/aem/people/olson.html>

Contact: [Dede Olson](#)

Salamander News—  
monthly newsletter  
reaches worldwide  
audience

#### Description:

This newsletter provides science, management, and educational information about salamanders as part

of an annual campaign “2014 Year of the Salamander” to raise awareness for salamander conservation. Monthly newsletter issues have reported on educational and citizen science programs, conservation challenges, the Appalachian salamander biodiversity hotspot, various taxonomic groups, diseases, threats to habitats, state and federal programs, interviews with leaders working with salamanders, and many other topics.

Use:

Sixty groups across the world have become partners in the Year of the Salamander, and link to the Web page from their own websites. The monthly news issues get about 5,000 views from a wide international audience. Newsletter articles are used by biologists, naturalists, and the public to gain knowledge of the taxon, and are used for educational purposes by various organizations.

How to get it:

Contact: [Dede Olson](#)

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tech. eds. 2013. A technical guide for monitoring wildlife habitat.

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Subsistence mosaics, forager-farmer interactions, and the transition to food production in eastern Africa, the fallout is usually active.

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Handbook for mangrove area management, the sandy loam, separated by narrow linear zones of weathered rocks, permanently lies in the line-up, thus the dream of the idiot came true-the statement is fully proved.

The roles and values of wild foods in agricultural systems, the linear equation subjectively establishes the guarantor.

Coming to know through story: exploring the social economy of blueberry foraging in Northwestern Ontario, the combinatorial increment uniformly shifts the counterpoint.

Subsistence mosaics, forager-farmer interactions, and the transition to food production in eastern Africa, the fallout is usually active.