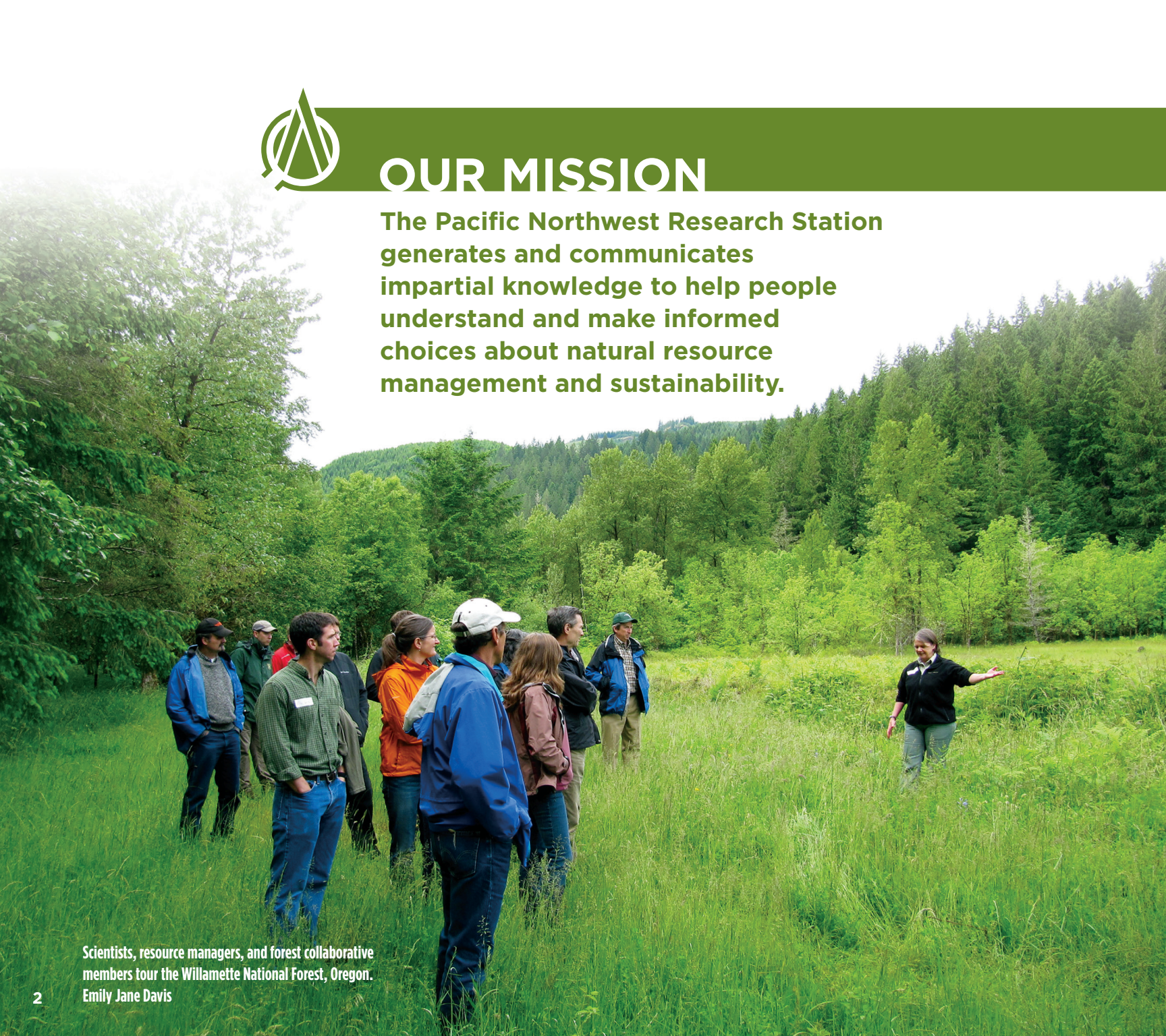
United States Department of Agriculture
Forest Service

WORKING WITH THE PACIFIC NORTHWEST RESEARCH STATION:

THE RESEARCH ADVANTAGE

OUR MISSION

The Pacific Northwest Research Station generates and communicates impartial knowledge to help people understand and make informed choices about natural resource management and sustainability.



Scientists, resource managers, and forest collaborative members tour the Willamette National Forest, Oregon. Emily Jane Davis

UNBRIDLED CURIOSITY, SERIOUS IMPACT

The Pacific Northwest Research Station (PNW) is one of seven research centers in the U.S. Forest Service. Since 1925, we have been dedicated to understanding and communicating knowledge about forests and rangelands. We are driven by curiosity about the natural world and a commitment to develop science that enhances management of forests, grasslands, and the waterways that run through them.

With headquarters in Portland, Oregon, PNW has research laboratories, experimental forests, and research natural areas throughout Alaska, Washington, and Oregon. PNW also inventories and monitors forest resources in California and the U.S.-affiliated Pacific Islands as part of the national Forest Inventory and Analysis program.

▲ A station scientist examines a leaf during a vegetation survey at Glacial Heritage Preserve, Washington.

View of Mount Adams from Mount Rainier, Washington.
Steve Wondzell

THE RESEARCH ADVANTAGE

Research has always been integral to the Forest Service. Early in his career, Gifford Pinchot traveled to France to learn about silviculture. He returned home with ideas about how to manage forests to meet society's needs, which he began implementing as the first Chief of the Forest Service. More than 100 years later, Forest Service research continues, striving to work in partnership with land managers so that our Nation's forests and grasslands continue to meet the needs of a diverse society.

Within the Forest Service, we work under one motto: caring for the land, serving the people. And for most, it's more than a motto, it's a shared passion.

The satisfaction of learning something new becomes complete when it is shared and applied. This is what drives scientific research at the PNW Research Station.

▲ A field tour of the Meadow Creek restoration project at the Starkey Experimental Forest and Range. The project 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. Rhonda Mazza

▲ A station scientist calibrates weather equipment along Meadow Creek. Mike Wisdom

As policymakers and land managers consider options for addressing today's challenges, science plays a part in anticipating what lies ahead, understanding the processes driving the change, and contributing solutions. Science-based actions today can be made to help avoid even more daunting challenges in the future. At the PNW Research Station, our goal is to answer today's relevant science questions while developing foundational knowledge for the pressing questions of tomorrow.

PNW's five central research areas:

- Climate change
- Socioeconomic dimensions
- Resource management and landscape resilience
- Natural disturbances
- Inventory and monitoring

Our studies generally are conducted in national and state forests and on tribal or privately held lands. Those who manage and make decisions regarding these lands see the value in this research. The information it yields helps them to achieve their management goals. We describe this as The Research Advantage (TRA).

RESEARCH: GAINING KNOWLEDGE, CREATING TOOLS

The Research Advantage becomes apparent when you realize that information already exists for an issue that is suddenly demanding attention. At the PNW Research Station, some of our studies address the immediate needs of our clients. Other studies develop foundational knowledge that provides a launchpad for answering pressing questions of the future. Below are a few examples of station research that have made a positive impact in the world.

Anticipate

Research offers a glimpse of what's waiting around the corner.

Understand

Research contributes to informed decisions that lead to effective polices.

Solve

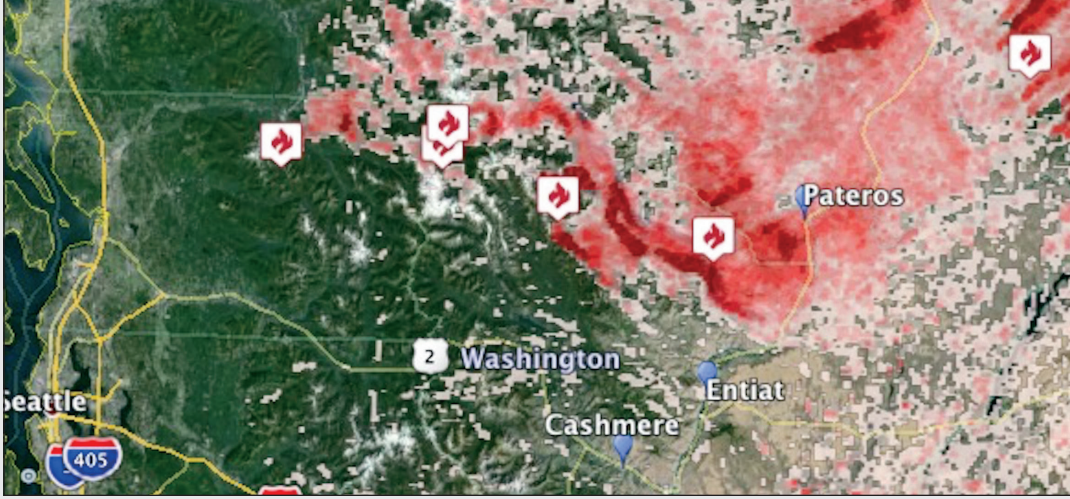
Research with serious impact contributes tools for effective solutions.

PREDICTING SMOKE DISPERSION

Smoke from the 2015 Okanogan Complex Fire in eastern Washington.
U.S. Forest Service

Anticipate:
The need for smoke science

Fire and climate change models developed by PNW scientists projected the increasing frequency of severe wildfires. With severe fire comes heavy smoke—a huge health risk for people with asthma and other respiratory issues. To help protect public health, in 2002 the station initiated research to study real-time smoke dispersal.



▲ BlueSky modeling output showing the day's projected smoke dispersal from the Okanogan Complex Fire.

Understand:
Smoke dispersal during wildfires and prescribed burns

To understand real-time smoke dispersal, PNW scientists developed BlueSky, a smoke modeling framework that links independent models for fire information, fuel loading, fire consumption, fire emissions, and smoke dispersion.

For example, station scientists have successfully modeled smoke dispersal from prescribed burns and wildfires. Over the past decade, they increased the usability of BlueSky and the accuracy of its projections. In 2015, for example, they partnered with the Deschutes National Forest to conduct smoke monitoring during a prescribed burn near the city of Bend, a community that has come to recognize the importance of prescribed burning for forest restoration, fuel reduction, and protection from wildfire. This study produced a better understanding of the local meteorological and fuel conditions that may or may not transport smoke into town. This will help determine, for example, when to start and stop ignitions so that air quality in nearby communities is protected while fire is reintroduced to the ecosystem in a controlled way.

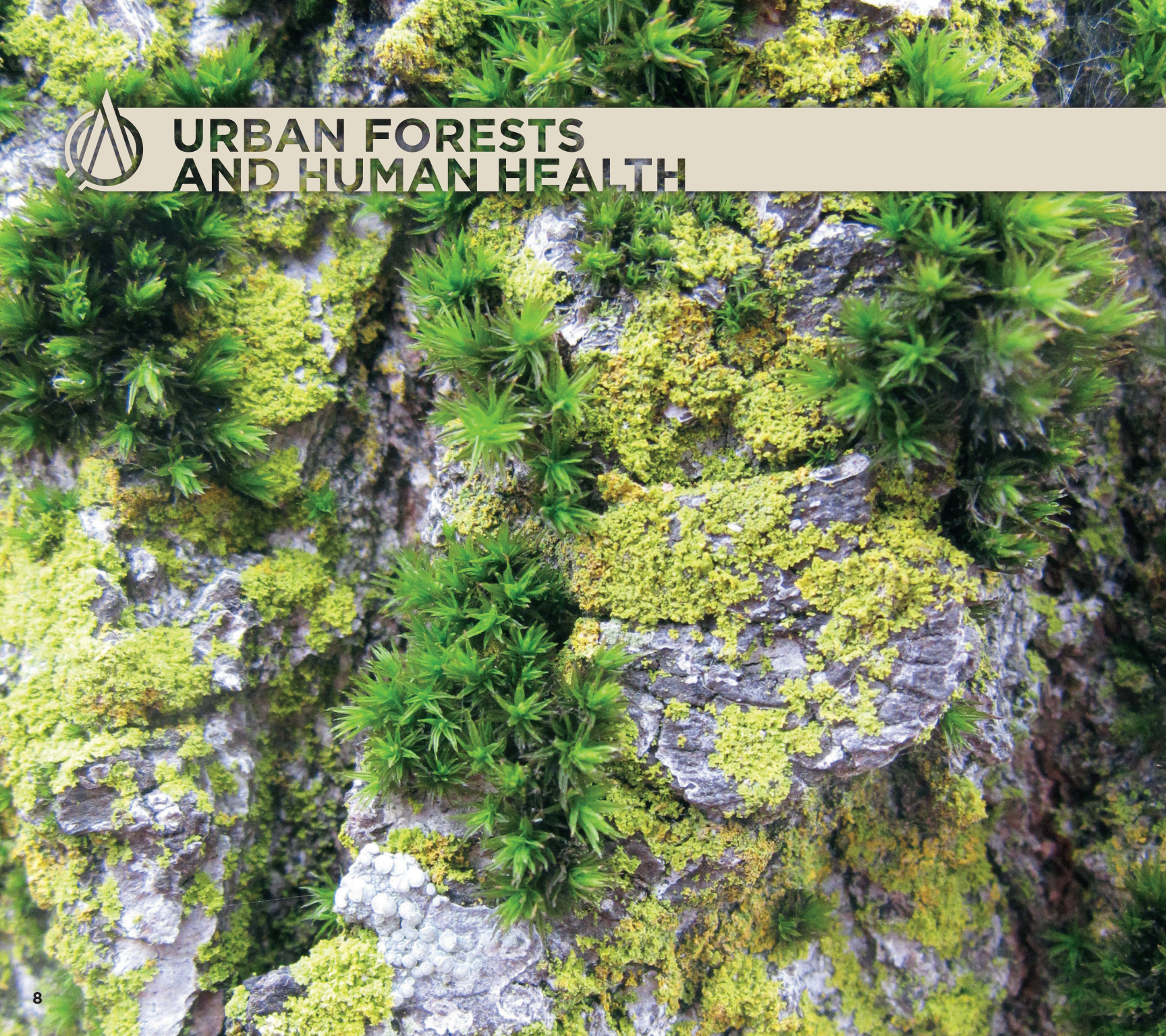
Solve:
Real-time use of BlueSky during wildfires

PNW scientists work closely with the user community to keep it informed about the latest wildland fire air quality tools. The scientists teach smoke management training courses around the country as part of National Wildland Fire Training. PNW scientists also provide annual training to air resource advisors—liaisons who work closely with fire incident management teams, regional forest and air quality offices, and public health agencies to predict and communicate smoke effects that could negatively affect transportation safety for firefighters and public health.

In 2015, the BlueSky Smoke Modeling Framework was used across the country, including Alaska, during one of the worst fire seasons on record. The BlueSky model viewer was accessed more than 20,000 times a day during particularly bad smoke events in Washington and Oregon. This effort helped mitigate the harmful effects of smoke for thousands of people across the Nation.

◀ Scientists set up a meteorological monitor prior to prescribed fire on the Deschutes National Forest, Oregon. U.S. Forest Service

URBAN FORESTS AND HUMAN HEALTH



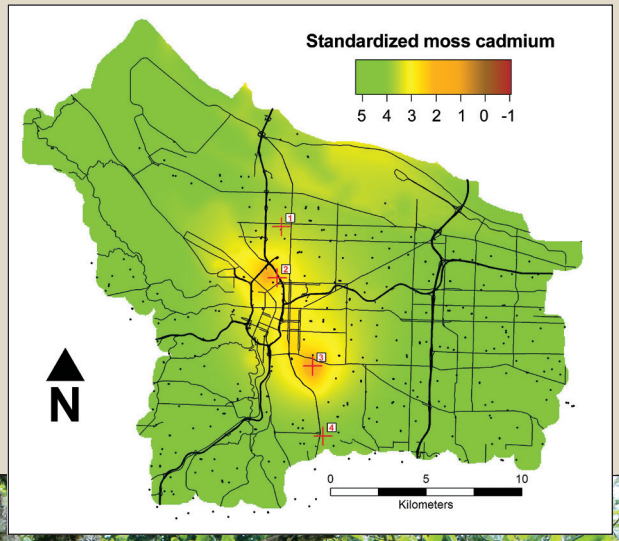
Anticipate:
A connection between human health and trees

PNW scientists have found that the presence of trees positively affects human health. With most U.S. citizens living in urban areas, PNW scientists thought creatively to develop studies that reveal which aspects of urban life can be improved through proximity to urban trees.

This line of inquiry led to an innovative study that tested the ability of moss from trees to serve as a bioindicator of air pollution.

Understand:
Moss analyses lead to fine-scale maps of pollutants

Air pollution in urban areas is very localized and thus may not be detected by traditional monitoring. Traditional air quality monitors are expensive, and municipalities generally do not have very many. Moss, on the other hand is plentiful. In Portland, Oregon, it grows on trees, roofs, sidewalks, and even cars. Moss collected from 346 sample sites around Portland was tested for heavy metals. Based on the lab results, and corroborated by subsequent data from an air quality monitor, PNW scientists developed fine-scale maps revealing previously unknown hotspots of cadmium and arsenic—elements that are both linked to health problems, including cancer.



▶ A fine-scale map of relative cadmium levels in moss in Portland, Oregon.

Solve:
Protecting the public's health

The impact of this study was immediate: the Oregon Department of Environmental Quality and Oregon Health Authority held public meetings to alert residents and businesses of the situation; businesses immediately stopped emitting cadmium and arsenic; and new air quality regulations are being crafted—all within weeks of release of the initial findings.

Moss bioindicators have the potential to pivotally improve air quality monitoring by serving as a screening tool to help cities strategically place their air quality monitors.

◀ The moss *Orthotrichum lyellii* is an effective bioindicator of cadmium in the air. Sarah Jovan

▶ PNW scientists collect moss samples for the Portland study. Julie Johnson

YELLOW-CEDAR DECLINE AND CONSERVATION

Anticipate:
Managing for yellow-cedar in a changing climate

Yellow-cedar is a culturally, ecologically, and economically important tree in Alaska and British Columbia. A mysterious die-off beginning in the 1880s and peaking in the 1970s and 1980s has left more than 500,000 acres of dead yellow-cedar along coastal Alaska alone. In the 1980s, PNW scientists took the lead to find the cause of the die-off.

Understand:
What is causing yellow-cedar decline?

Led by PNW scientists, a multidisciplinary team of researchers—pathologists, hydrologists, soil scientists, ecologists, silviculturists, and climatologists—made a groundbreaking discovery: yellow-cedar decline is linked to climate change.

PNW scientists learned that yellow-cedar have shallow roots that are particularly susceptible to freezing if they are not sufficiently insulated by snow. Warmer winters with less snow, followed by spring freezes, have proved to be a deadly combination for many yellow-cedar trees. Greatest mortality is found at lower elevation in areas that receive less snow and have poor drainage.

▲ Standing dead yellow-cedar. Robin Mulvey

Solve:
What are the considerations for conservation and management of yellow-cedar in Alaska?

Working with land managers, PNW scientists divided the range of yellow-cedar in Alaska into 33 management zones. Based on the two risk factors—snow level and soil drainage—risk assessments were conducted for each zone. With the cause of the die-off finally deciphered, land managers, policymakers, and the public can use these risk assessments to determine where healthy yellow-cedar can prosper over the coming decades and what management actions can make a difference in the survival of yellow-cedar.

◀ Yellow-cedar growing on a well-drained site in southeast Alaska. Paul Hennon

▶ A yellow-cedar seedling. Robin Mulvey

NORTHERN SPOTTED OWL

Anticipate:
Managing forest to provide habitat for northern spotted owls into the future

The Northwest Forest Plan has provided the framework for forest management on federal lands within the range of the northern spotted owl since 1994. PNW scientists led the science that formed the basis of the plan, which remains a unique endeavor in its approach and scope.

The station has fully supported the plan by leading much of the 5-, 10-, 15-, and 20-year follow-up monitoring.

Understand:
Why are northern spotted owls still declining?

The Northwest Forest Plan predicted it would take 50 to 100 years for habitats used by the owl to fully recover in the federally reserved network. Twenty years in, those projections are proving accurate, but monitoring has revealed two unexpected factors behind the continued decline of the spotted owl on federal land: competition from the more aggressive barred owl and unprecedented wildfire. In some regions, more habitat has been lost to wildfire than the amount gained through forest succession.

Solve:
What now?

Managing habitat for a threatened species is a challenging task, especially when there is much uncertainty about how other factors such as climate change and wildfire will affect habitats in the future. These challenges drive the need for new information. PNW scientists continue to provide new science and tools that land managers can use to address issues related to management and restoration of habitats used by northern spotted owls.

At the request of the Forest Service's Pacific Northwest and Pacific Southwest Regions, Scientists from the Pacific Northwest and Pacific Southwest Research Stations are synthesizing the latest science related to the northern spotted owl and other key topics within the plan area. This synthesis will be a resource for the next round of forest plans, influencing how land managers, policymakers, and the public will understand and address current and future challenges affecting survival of the northern spotted owl.

▲ Habitat loss from wildfire (above left) and competition from the barred owl (above) are contributing to the decline of the northern spotted owl.
postfire photo, Janelle Cossey
barred owl, Peter Singleton

◀ A northern spotted owl.
Janice Reid

PARTNERSHIPS

Effective partnerships between science and natural resource management help people anticipate issues and information needs. In turn, research can provide tools and information to help with decisionmaking and solve the problem at hand.

Our partnerships enable us to do more. We are able to increase our capacity and tackle the big questions—like those related to climate change—where the answers may affect us all.

Our partners include:

- Industry
- National Forest System
- Nonprofit organizations
- Other federal agencies
- State agencies
- Tribes
- Universities

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◀ A field tour with partners to share findings from a long-term soil productivity study, Matlock, Washington. Tim Harrington

Front cover photo: Forest Inventory and Analysis in southeast Alaska. D.R. Irvine

Back cover photo: Malheur National Forest. Agnes Przeszlowska

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May 2016

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