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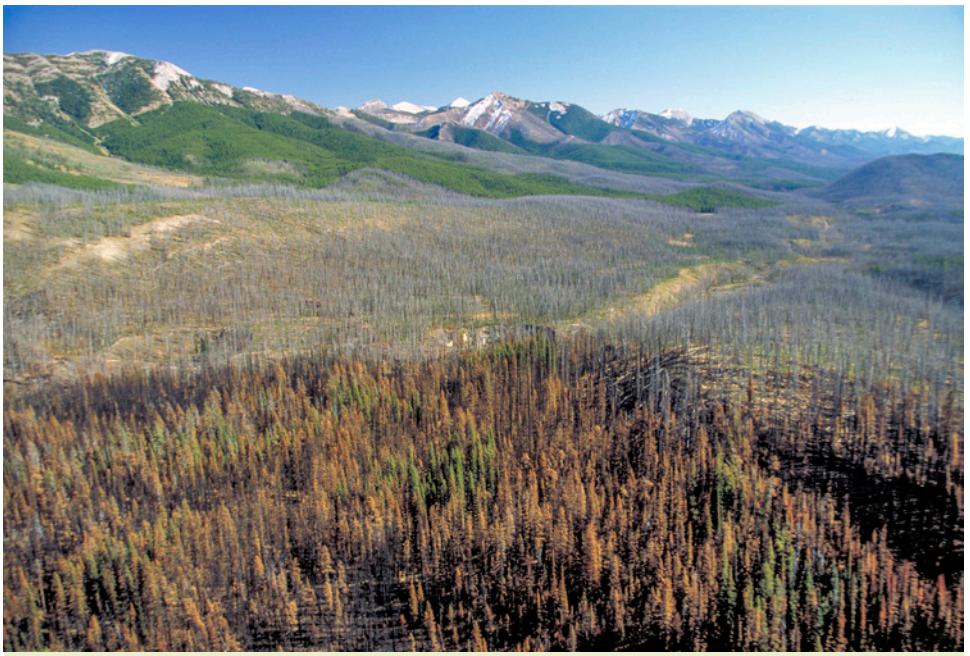
# Wildland Fire: Nature's Fuel Treatment



*A fire in Montana's Bob Marshall Wilderness stopped at the edge of an older burn (source: Kari Greer Photography).*

SUMMARY

Every year wildland fires affect much more acreage in the United States compared to controlled burns. Like controlled burns, wildland fire can help promote biological diversity and healthy ecosystems. But despite these facts, wildland fire is not often considered as a fuel treatment in the United States.

Scientists working with the U.S. Forest Service's Rocky Mountain Research Station have evaluated more than 40 years of satellite imagery to determine what happens when a fire burns into a previously burned area. Results from this research are helping land managers to assess whether a previous wildland fire will act as a fuel treatment based on the length of time since the previous fire and local conditions such as ecosystem type, topography, and fire weather conditions. By factoring in the ecological benefits of fire, land managers are able to manage fire in a way that fosters more resilient landscapes.

For more information or to get an opinion on a specific fire scenario, land managers can contact Sean Parks at sean_parks@fs.fed.us or Carol Miller at cmiller04@fs.fed.us.

The Irish poet William Butler Yeats was fascinated by a cyclical view of history—the idea that, just as the four seasons repeat themselves year after year, history follows a cyclical course. His poetry is filled with allusions to birth, death and renewal such as reincarnation, the 28-day lunar cycle and the phoenix, the mythical bird that dies in a self-created fire and is then reborn from its own ashes.

Yeats would likely approve of the research conducted by Sean Parks and others at the U.S. Forest Service. A research ecologist based out of Missoula, Montana, Parks sees wildland fire as part of a self-regulating cycle that temporarily reduces landscape-level

vegetation and fuel—a natural process that can reduce the size, spread, severity, and even the occurrence of future fires. Wildland fires can reduce live and dead vegetation, while the ashes that remain can release nutrients that have been locked in older vegetation, which benefits surviving or regenerating trees and other vegetation. Wildland fires can also improve forest health by reducing the density of trees, which reduces competition for necessary resources such as light and water.

Parks and his colleagues focus on several aspects of fire ecology in the forested regions of the western United States, including the analysis of wildland fire as a method of reducing future fire impact. As Parks describes it, "I conduct scientific studies that evaluate what happens when a fire runs into a previously burned area."

"A number of plant species have evolved with fire and have adaptations that allow them to persist after fire," Parks goes on to say. "These adaptations may include thick bark, the ability to resprout, and the ability to easily reseed. Once you remove fire via fire suppression, you throw ecosystems out of whack. Given that fire will inevitably burn any given area, removing fire today often sets the stage for a more severe fire in future years."

## HOW COMMON ARE "UNPRESCRIBED" FIRES?

Though it's not always thought of as a fuel treatment, wildland fire has the potential to consume fuel and alter vegetation structure in much the same way as prescribed fires. However, wildland fire—whether naturally occurring or an accidental, human-caused blaze—leaves a much bigger footprint than prescribed fire. According to data from the National Interagency Fire Center, wildland fires in the conterminous western U.S. States burned more than 10 times as many acres on average from 2011 to 2015 compared to prescribed fires. As Parks explains, "In the western U.S., prescribed burns are typically only a couple hundred acres or less—they barely make a dent. Wildland fires cover a lot more ground and have a lot more treatment impact."

*Wildland fires that reduce vegetation density and fuel loads can reduce future fire size, severity, spread, and occurrence (source: Kari Greer Photography).*

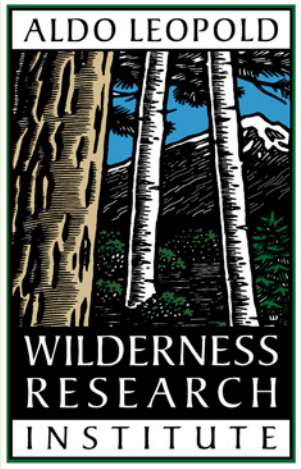
*"Prescribed burns are typically only a couple hundred acres or less—they barely make a dent. Wildland fires cover a lot more ground and have a lot more treatment impact." —RMRS research ecologist Sean Parks*

What does this mean to land managers? Faced with a wildland fire, land managers need to know when and where to suppress the fire, and when and where to allow nature to take its course.

It's not an easy decision. According to Carol Miller, who works with Parks at the Rocky Mountain Research Station's Aldo Leopold Wilderness Institute, "It can be really hard for a wilderness manager to let a fire burn. There are neighboring properties to consider, for one thing. And there's the fact that we've been suppressing fires for so long that the result of a fire may not be what people want to see."

**Promoting Wilderness Stewardship: Aldo Leopold Wilderness Research Institute**

Tucked away on the southern edge of the University of Montana campus is an unassuming building with an appearance that belies its importance. Named after a co-founder of the Wilderness Society, the Aldo Leopold Wilderness Research Institute (also known as the Leopold Institute) is a unique organization that represents collaboration between five Federal agencies with wilderness management or research responsibility: the Bureau of Land Management, the U.S. Fish and Wildlife Service, the U.S. Forest Service, the National Park Service, and the U.S. Geological Survey. It's a national center where scientists from different disciplines can address the wilderness research needs of land management agencies and organizations.




*The Leopold Institute is a collaboration of multiple Federal agencies for the development of knowledge to improve management of protected lands.*

Formally established in 1993 by the U.S. Forest Service and administered by the Rocky Mountain Research Station, the Leopold Institute is where Sean Parks and Carol Miller work as research ecologists. "It's the only Federal research group in the United States dedicated to the development and dissemination of knowledge about wilderness preservation management," Miller says. "Sean's research is really a capstone for the Leopold Institute, which goes beyond the short-term risks of fire to highlight the longer-term benefits of letting wildland fires burn." Or, as Aldo Leopold himself pointed out, "Too much safety seems to yield only danger in the long run."

More information on the Leopold Institute can be found at http://leopold.wilderness.net.

Miller adds that land managers may face a double standard when it comes to fire decisions: "If you let a fire burn and something goes wrong, you're under a lot of scrutiny. But if you suppress a fire and that contributes to a subsequent fire being especially destructive, no one questions that."

Miller uses as an example the 1988 Canyon Creek Fire in Montana's Bob Marshall Wilderness: "Orville Daniels, who was the supervisor of Lolo National Forest, made the decision to let a wildfire burn, and due to weather conditions that no one could have foreseen, the fire got out of control. He got a lot of criticism at the time, but he stood by his decision. He said that the only mistake he made was in putting out an earlier fire that had been in the same area. If the earlier fire had not been put out, the Canyon Creek Fire probably would have burned into that old burned area and stopped spreading."

## RESEARCHING NATURE'S FUEL TREATMENTS

Given an increased emphasis on restoring landscape resilience, along with the expectation that extreme fire weather is becoming more common, Parks and his colleagues believe that land managers will be asking the following questions with increasing regularity:

- Will a previous or presently occurring wildland fire be an effective fuel treatment? If so, for how long?
- How do local weather conditions and ecosystem type impact the length of time that wildfires serve as effective fuel treatments?

To help answer these questions, Parks and his colleagues used satellite data and other resources to research fires from 1972–2012 in four Federally protected areas: the Frank Church-River of No Return Wilderness in central Idaho, the Selway-Bitterroot Wilderness in north-central Idaho and western Montana, the Crown of the Continent region of northern Montana, and the Gila and Aldo Leopold Wilderness Areas in New Mexico. All four regions have an established history of allowing wildland fires to burn.

## TODAY'S FIRE: TOMORROW'S FUEL TREATMENT

According to Parks, the research shows that past fires limit the size, spread, severity, and occurrence of subsequent fires in the northern Rockies and the Southwest. "Today's fire is tomorrow's fuel treatment," Park explains.

The lower severity his team found in reburns compared to no-reburns is likely due to the consumption of "dead and

*Scientists tracked historical fires in parts of Gila National Forest, pictured here in 2012 (source: Kari Greer Photography).*

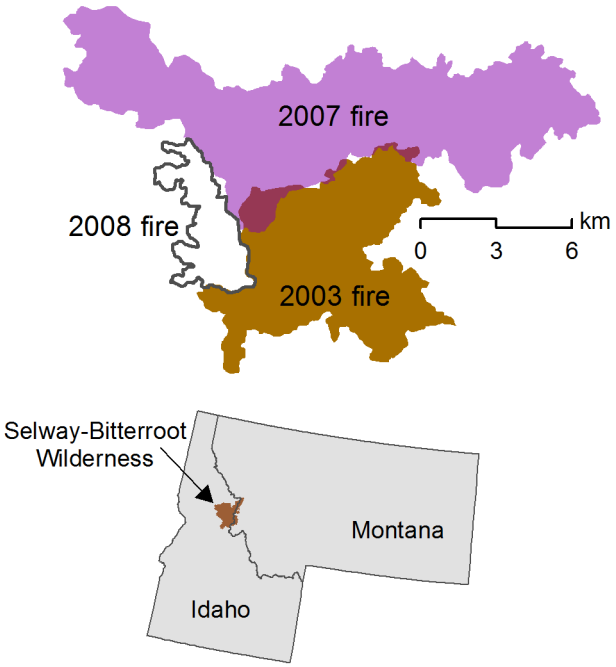
down" fuel by previous fires, which reduce fuel availability for subsequent fires. Another possible reason is that previous fires can cause changes in vegetation amount, structure and composition, a process that reduces ladder fuels and the likelihood of torching of the upper canopy during subsequent fires.

Overall, Parks and his team found that wildland fire can act as a fuel treatment that:

- Reduces occurrence of subsequent fire for eight to 25 years or more
- Limits size of subsequent fire for six to 18 years
- Limits severity of subsequent fire for 20 years or more

Parks explains that the wide time ranges are the result of factors such as ecosystem type, fire weather, vegetation types, previous fire severity, and topography. For example, Parks and his colleagues found that the length of time that a fire was an effective treatment was shorter in the warm and dry study area in New Mexico compared to the cooler, wetter areas in the middle and northern Rocky Mountains.

Likewise, the length of time that a fire was an effective fuel treatment was shorter when an area experienced increasingly fire-conducive weather conditions. Specifically, in the Selway-Bitterroot Wilderness study area, Parks and his team found a 70 percent likelihood that a 15-year old burn scar will limit the spread of a fire under moderate fire weather conditions. Under extreme fire weather conditions, that likelihood is only 25 percent. As a result, Parks says, "Suppressing a fire




*A wildfire occurring in 2003 had a regulating effect on a 2007 wildfire in the Selway-Bitterroot Wilderness, just as the 2003 and 2007 wildfires had a regulating effect on a wildfire in 2008 (source: Sean Parks).*

*A 2005 wildland fire helped divert a much bigger fire in 2013 around the Magruder Ranger cabin in Bitterroot National Forest (source: Mel Holloway).*

can be a lost opportunity to restore ecological resilience, especially during non-extreme weather conditions."

Parks cautions that several factors they did not explore can affect where and when fires stop spreading. These variables include wind direction, natural fuel breaks and man-made features such as roads.

## BUILDING ON PAST FIRE RESEARCH

The team's findings build on research conducted by many other scientists, including Jan van Wagtendonk, who worked as a research scientist at Yosemite National Park for 36 years. According to van Wagtendonk, "Yosemite was under a fire suppression policy until 1972, when the policy was changed to allow fires to burn under prescribed conditions. Yosemite had a significant fire in 1974, in the Illilouette Creek drainage area, and there have been multiple fires in that area since then. It's given us 40-plus years to see how these fires interact. This research, along with Sean's work across a much wider area, has been a real proof of concept of how subsequent wildfire severity has been affected by previous fires."

*"Stephen Pyne, a fire historian in Arizona, has said, 'Every wildland fire put out is a fire put off.' Well, a lot of people say, 'I want to put it off.'" — Dave Campbell, retired Bitterroot National Forest District Ranger*

Dave Campbell, a retired District Ranger who worked at Bitterroot National Forest, has also seen the research play out first-hand. He says, "When you put Sean's research together with all the other Forest Service wildfire research that's been done over the years, it tells a compelling story. Land managers know a lot of it already but the public doesn't—they often say they'd like to keep things the way there are. Stephen Pyne, a fire historian in Arizona, has said, 'Every wildland fire put out is a fire put off.' Well, a lot of people say, 'I want to put it off.'"

## MANAGEMENT IMPLICATIONS

- While land managers have long known the potential value of previous fires in limiting the size, severity, spread, and occurrence of subsequent fires, there has historically been a lack of quantitative information to help land managers evaluate specific fire scenarios.
- Ongoing U.S. Forest Service research can assist land managers with fire management planning by helping to assess whether a previous wildland fire will act as a fuel treatment based on its age, ecosystem type, and local weather.
- Application of this research can provide land managers with greater flexibility and confidence in managing fire and promoting resilient landscapes.

*Ongoing Forest Service fire research can help land managers decide where to suppress a wildland fire and where to let it burn (source: Kari Greer Photography).*

## KEY FINDINGS

- Wildland fires can act as fuel treatments that reduce the size, severity, spread, and even occurrence of subsequent fires because they reduce fuel loads.
- The length of time that wildfires serve as effective fuel treatments varies by ecosystem type and diminishes under severe fire weather conditions.
- There may be long-term benefits from a wildland fire that is managed for resource benefit, whereas suppressing a fire may represent a lost opportunity to restore ecological resilience, especially during non-extreme weather conditions.
- U.S. Forest Service research can help land managers determine how effective a past fire might be in reducing the size and severity of a subsequent fire in the same location.

Campbell said that after seeing hundreds of wildland fires, the fuel reduction benefit is clear to him—and sometimes helpful in protecting historic resources. He described a few recent fires near Bitterroot's iconic Magruder Ranger Station cabin, which can be rented out for a backcountry experience near the Selway River: "Back in 2005, the Beaver Jack wildfire got pretty close to the cabin, probably closer than we would have gotten away with if we'd done a controlled burn. Then in 2013 there was an even bigger fire, the Gold Pan fire. That fire started out in pretty normal conditions and then the weather spiked and it started to move toward the Magruder area. When it hit the Beaver Jack fire site it bypassed Magruder and came around the other side. Between the two fires, they wound up completing the fuel reduction for Magruder, helping to treat an area that it would have been difficult for us to treat ourselves."

*"It's important that managers also consider the long-term benefits of fire and not simply the perceived short-term costs." —RMRS research ecologist Sean Parks*

## APPLYING THE KNOWLEDGE

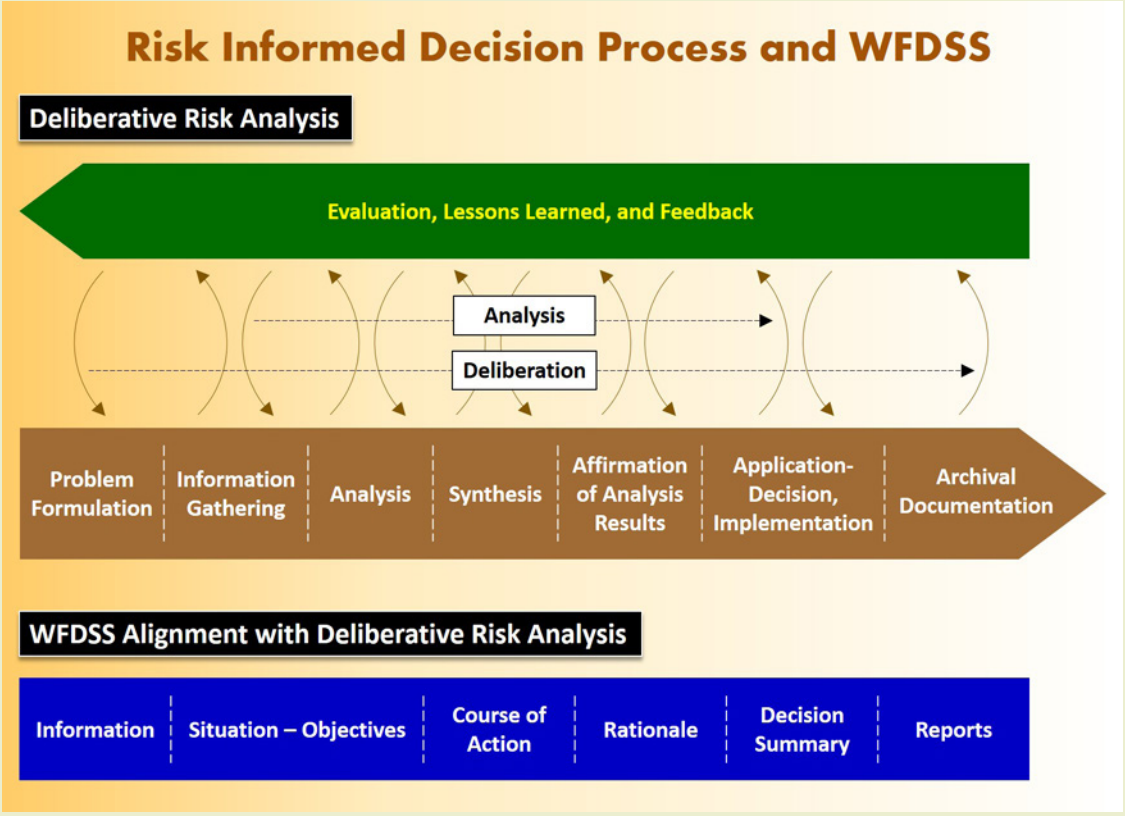
Parks is hopeful that his team's research will help land managers broaden their perspective of fire. "Managers typically don't make a fire decision based solely on ecological principles or science," Parks explains. "Things like air quality, public perception, and land use are often the deciding factors. A land manager may get a phone call saying, 'I have an

**Wildland Fire Decision Support System**

In response to increased wildland fire complexity, the need for standardization, and improved efficiency, the National Fire and Aviation Executive Board chartered the Wildland Fire Decision Support System (WFDSS) in 2005. WFDSS assists fire managers and analysts in making strategic and tactical decisions for fire incidents. WFDSS integrates the various applications used to manage incidents into a single system, which streamlines the analysis and reporting processes. The simple and intuitive web-based system:

- Combines desktop applications for fire modeling into a web-based system for easier data acquisition;
- Provides an easy way for fire managers and analysts to accurately document their decisionmaking process by allowing results of analyses to be attached to the decision point and included in the final incident report;
- Provides one decision process and documentation system for all types of wildland fires; and
- Introduces economic principles into the fire decision process.

More information on WFDSS is available at http://wfdss.usgs.gov.




*The Wildland Fire Decision Support System supports risk-informed decisionmaking, which requires two distinct but linked processes: analysis and deliberation. The blue strip at the bottom shows the WFDSS decision flow process and how it lines up with deliberative risk analysis (source: Wildland Fire Decision Support System).*

elk camp there; you need to put out that fire.' But it's important that managers also consider the long-term benefits of fire and not simply the perceived short-term costs." Land managers can use the research in conjunction with the Wildland Fire Decision Support System (http://wfdss.usgs.gov), a decision support system that was chartered by interagency fire management executives, to assess risks and fire behavior during a wildland fire.

"The information is out there in the published literature," Parks says, "but if a land manager needs to find out the implications of a past fire, they're always welcome to contact us." For Parks and his colleagues, it all comes down to giving land managers the information they need to make informed decisions. As William Butler Yeats once said, "Education is not the filling of a pail, but the lighting of a fire."

## FURTHER INFORMATION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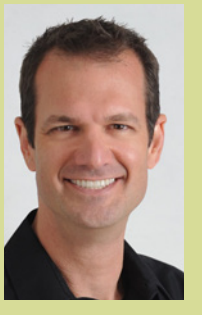
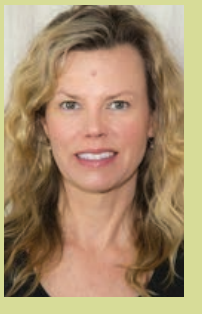


## WRITER'S PROFILE

**Brian Cooke** is a science writer for the Rocky Mountain Research Station in Fort Collins, Colorado. He has a bachelor's degree in journalism-science writing from Lehigh University in Bethlehem, Pennsylvania. In addition to his work for RMRS, Brian has completed writing assignments for the Northern Research Station, the National Park Service, various environmental services companies, and proposal writing and editing for Bureau of Land Management projects. Brian's science and environmental writing is frequently colored by his National Park Service interpretive training and experience as a volunteer docent for Alcatraz Island National Historic Landmark and San Francisco Maritime National Historical Park.



## PHOTOGRAPHER'S PROFILE

**Kari Greer**, whose photography is featured in this newsletter, is a photographer based near Boise, Idaho. Kari specializes in wildland fire photography, editorial photojournalism, and location and assignment photography. Her interest in wildland fire photography was sparked during her college years, when she spent time on a Forest Service fire crew. Kari contracts with the U.S. Forest Service and the Bureau of Land Management. Her photography has appeared in numerous publications including Outside Magazine, National Geographic Adventure, Wildland Firefighter and The New York Times. Kari studied photography at California State University-Sacramento and Boise State University. Additional examples of her photography can be found at www.kariphotos.com and www.wildland-fires.smugmug.com.

## SCIENTIST PROFILES

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

**SEAN PARKS** is a research ecologist with the Aldo Leopold Wilderness Research Institute of the Rocky Mountain Research Station in Missoula, Montana. His research largely focuses on three areas: the role of wildland fire as a fuel treatment, the relationship between climate and fire regimes, and identifying factors that are likely to result in fire-facilitated conversion from forest to non-forest. He received the Rocky Mountain Research Station Early Career Scientist Publication Award for his 2015 Ecological Applications article on the role of wildland fire as a self-regulating mechanism. Sean has a doctorate in forestry from the University of Montana and bachelor's and master's degrees from the University of California, Davis.

**CAROL MILLER** is a research ecologist with the Aldo Leopold Wilderness Research Institute of the Rocky Mountain Research Station in Missoula, Montana. Her main responsibilities are to develop the understanding necessary to guide the stewardship of fire as a natural process in wilderness. Her research interests include: agents of landscape pattern formation; interactions among fire regimes, climate, and vegetation pattern; implications of fire suppression and our ability to restore fire as an ecosystem process; and the effects of climate change on disturbance regimes. Carol has a doctorate in ecology and a master's degree in forest sciences from Colorado State University and a bachelor's degree from Penn State University.

**LISA HOLSINGER** is an ecologist specializing in geospatial data analysis in the areas of wildland fuels, fire, vegetation, landscape ecology, and ecosystem management at the Rocky Mountain Research Station's Aldo Leopold Wilderness Institute and Fire Sciences Lab in Missoula, Montana. Lisa has also worked in mapping and modeling vegetation and fire for the LANDFIRE project at the Fire Sciences Lab. Prior to joining RMRS, she worked for the National Marine Fisheries Service in Washington and California doing research and management for the recovery of endangered salmon populations. She has a master's degree in fisheries from the University of Washington and a bachelor's degree in biology from the University of California, Davis.

**CARA NELSON** is an associate professor of restoration ecology at the University of Montana in Missoula. She directs the University's Restoration Ecology Lab, which focuses on increasing knowledge about ecological processes and their application to repairing degraded ecosystems. Specifically, Cara and her students investigate vegetation responses to large-scale disturbances, the efficacy and ecological impacts of ecological restoration, and sampling methods for detecting changes in ecosystem condition. Cara has a doctorate in forest ecosystem analysis from the University of Washington, master's degrees in conservation biology and forestry from the University of Wisconsin, and a bachelor's of science degree from The Evergreen State College in Olympia, Washington.

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**SCOTT BAGGETT** is a supervisory statistician with the U.S. Forest Service Rocky Mountain Research Station in Fort Collins, Colorado. His responsibilities include statistical consultation and supervision of the Station's Statistical Unit. Prior to working with the Forest Service, Scott was a senior statistician for the Jones Graduate School of Business at Rice University and a lecturer for Rice University's Department of Statistics. He has doctorate and master's degrees in statistics from Rice University, along with master's degrees in statistics from the University of Arkansas and oceanography from Texas A&M University and a bachelor's degree in zoology from the University of Oklahoma.

**BEN BIRD** is a statistician for the U.S. Forest Service Rocky Mountain Research Station in Fort Collins, Colorado. His responsibilities include statistical consultation for more than 100 research-grade scientists, alongside Scott Baggett, in the Station's Statistical Unit. Prior to working with the Forest Service, Ben was an instructor for Colorado State University's Department of Statistics. He has a master's degree in statistics from Colorado State University and a bachelor's degree in mathematics from Penn State University.

## Purpose of the Science You Can Use Bulletin

To provide scientific information to people who make and influence decisions about managing land. The US Forest Service RMRS Science You Can Use Bulletin is published regularly by:

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