

2011

ANNUAL ACCOMPLISHMENTS

ROCKY MOUNTAIN RESEARCH STATION



USDA FOREST SERVICE
www.fs.fed.us/rmrs

2007

2008

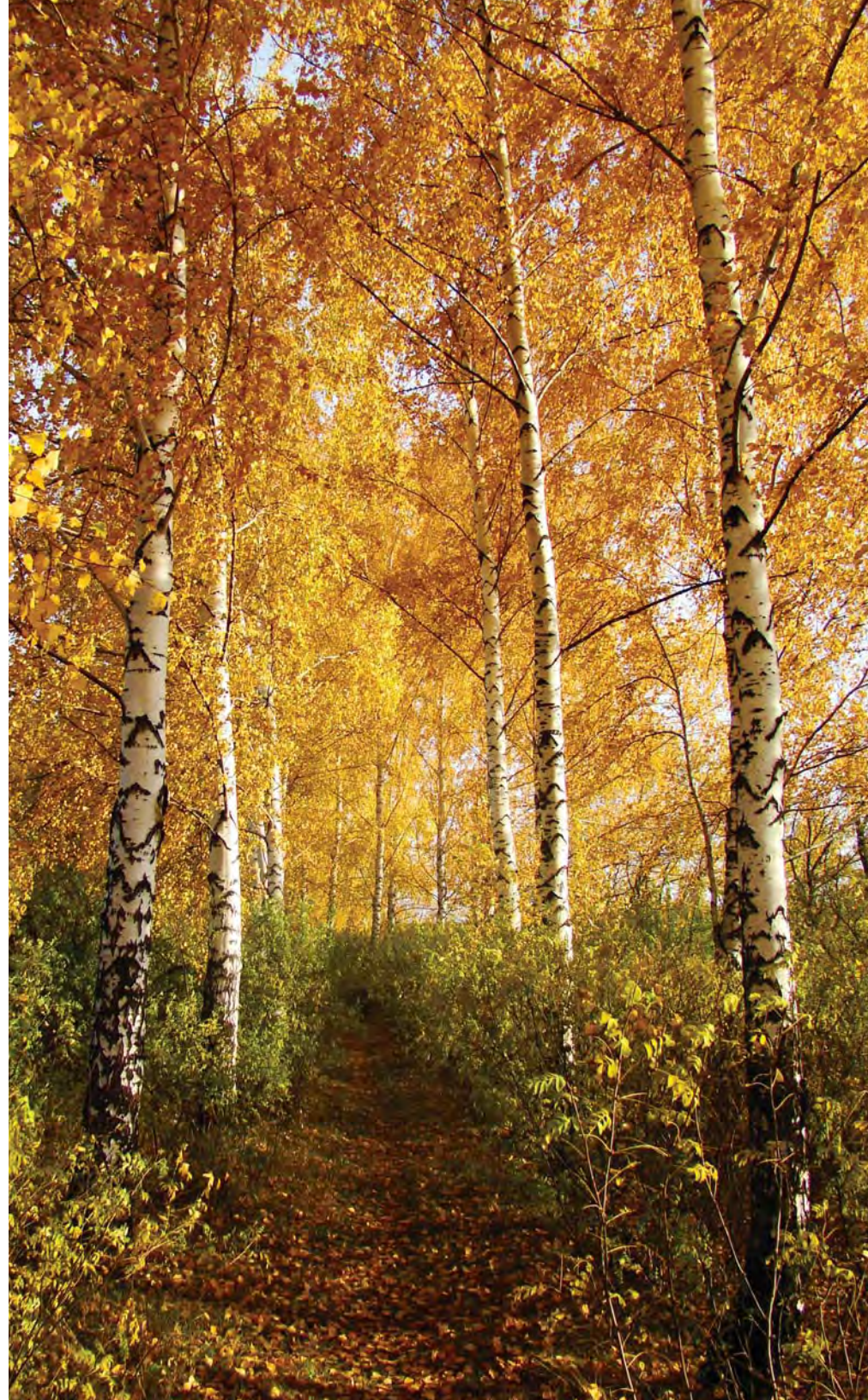
2009

2010

2011

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(Front Cover: Scientists at the Glacier Lakes Ecosystem Experiments Site (GLEES) in southern Wyoming re investigating the impacts of spruce beetle infestations on high-elevation spruce-fir forests. These photos show the progression of beetle damage at GLEES from 2007 to 2011).





A MESSAGE FROM THE DIRECTOR

Greetings,

The Rocky Mountain Research Station's long and storied track record of conducting relevant, ground-breaking natural resources research helps managers and planners balance economic and environmental demands for forest and rangeland resources both here and abroad. In 2011, we made great strides in meeting our customers' needs and finding ways to not only produce the best science, but also to share our science findings with those who need and use the new knowledge we generate.

It is my pleasure to bring you our 2011 annual report - a snapshot of our long-term research programs and accomplishments. As you peruse the report, you'll notice our focus on today's most important natural resources issues. Looking at 2012 and beyond, we will focus on four top priorities:

- **Landscape Scale Conservation** – This includes enhancing water resources; responding to the effects of climate change; working with communities on natural resource issues; and helping to enhance conditions for job creation in rural communities.
- **Safety and Wellness** – Nothing is more important than our employees returning home or to the office safely at the end of the workday, and providing a healthy environment to work in. This will continue to be elevated as one of my top focus areas.
- **Inclusiveness** – We will proceed to work hard to make sure our workforce is diverse and reflects society as a whole, and that the Rocky Mountain Research Station is a welcoming and rewarding place to work.
- **Partnerships and Customer Service** – We work with some of the best and most experienced partners who help us advance solutions to pressing natural resource problems. We will continue to maintain, build and nurture these partnerships and find ways to enhance our well-respected customer service.

The future challenges we face will become progressively more complex in issues impacting natural resources and our society. Our commitment to and enthusiasm for our central mission of producing and delivering the best science for our customers remains the same. I invite you to read through this 2011 Research Accomplishments report and learn more about us. Also, check us out on our website at www.fs.fed.us/rmrs.

Sincerely,

G. Sam Foster
Station Director

A LOOK AT RMRS

The Rocky Mountain Research Station is one of seven regional units that make up the USDA Forest Service Research and Development organization – the most extensive natural resources research organization in the world. We maintain 12 field laboratories throughout a 12-state territory encompassing the Great Basin, Southwest, Rocky Mountains, and parts of the Great Plains (see map). The Station employs a diverse workforce of approximately 400 permanent full-time employees, of which 91 are research scientists.

We administer and conduct research on 14 experimental forests, ranges and watersheds, while maintaining long-term databases for these areas (www.fs.fed.us/rmrs/experimental-forests). We also oversee activities on 273 research natural areas (www.fs.fed.us/rmrs/research-natural-areas).

Our research program serves the Forest Service as well as other federal and state agencies, international organizations, Tribes, students and professors, non-profit private groups, and individuals. Research results and products are made available through a variety of technical reports, journals, and other publications, and via web sites, webinars, seminars, symposia, demonstrations, exhibits, and personal consultations.

Our work enables resource managers and planners to balance economic, social and environmental demands for forest and rangeland resources worldwide.



The Station's largest customer base is comprised of our Nation's National Forests.

Partnerships:

Equally critical to our successes are our partnerships with others. To help advance solutions to pressing natural resource problems, the Station maintains key partnerships with:

- **National Forest Systems** – Forest supervisors and managers comprise the Station's largest customer segment or stakeholder group.
- **Other Federal Land Management Agencies** – The Station serves managers of the largest public land holdings in the United States, including the Bureau of Land Management, National Park Service, Bureau of Reclamation, U.S. Fish and Wildlife Service, and Department of Defense.
- **Other Federal Non-land Management Agencies** – We provide regular consultation to the Environmental Protection Agency, National Marine Fisheries Service, Natural Resources Conservation Service, and Bureau of Indian Affairs.



States rely on the Station's Inventory and Monitoring Program for resource data for planning.

- **State, Local and Other Public Agencies** – Our Inventory and Monitoring science program is the Station's largest program and provides eight western states with resource inventory and monitoring data for use by state, county and urban planners, state resource agencies, industry and others.
- **Industry** – The forest products industry is an important customer for tree improvement, forest productivity, insect and disease, genetics and engineering technology research.
- **Non-government Organizations (NGOs)** – Citizens representing their own and community interests are becoming increasingly aware of, and are valuing scientific developments.
- **Tribal Governments** – The Station actively engages with several Native American Tribal governments and Tribal organizations to exchange knowledge and collaborate on projects.
- **International Cooperators** – Station scientists collaborate on a global scale with scientists, universities, institutions, and government agencies on a variety of natural resource projects and issues.
- **University and Non-university Cooperators** – We maintain an active cooperative research program with several universities and other partners in order to share resources, expertise and facilities.



Near Gothic, CO.

RMRS scientists and support personnel work to efficiently and effectively increase the understanding of Interior West ecosystems and management strategies, and provide the best service and tools possible to our customers.

The next few pages spotlight important studies underway throughout our 12-state territory. These and additional studies are featured at www.fs.fed.us/rmrs/research/highlights. For a more comprehensive look at what we do at the Rocky Mountain Research Station, please visit our website at www.fs.fed.us/rmrs.

OUR SCIENCE

Science Programs



Grassland, Shrubland & Desert Ecosystems

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Forest and Woodland Ecosystems

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Fire, Fuel and Smoke

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Air, Water and Aquatic Environments

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Inventory, Monitoring and Analysis

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Wildland Fire

Fire is a major disturbance shaping ecosystems and peoples' lives. Managing landscapes prone to wildfire is a complicated task that becomes ever more urgent as wildfires become more severe, especially in the western United States. Station scientists provide practical, science-based knowledge and tools to support public and private land managers in:

- smoke management
- fire suppression
- fuel classification and monitoring
- fuel reduction and biomass utilization
- postfire restoration
- protecting homes in the wildland-urban interface
- predicting fire behavior and the effects of fire on forest and rangeland resources
- reducing fuels and fire risk.

Research results help reduce losses to society from fire, and improve and maintain the resilience and sustainability of our Nation's natural resources.

DID YOU KNOW?

At the request of U.S. Senator Mark Udall (CO), a team of Station scientists spent much of 2011 conducting an assessment of Colorado's 6,000-acre Fourmile Canyon Fire (2010) – the most destructive fire in the State's recorded history. The in-depth analysis will be used to inform decision makers, land management agencies and other interested stakeholders about lessons learned from the fire. The draft assessment is available at www.fs.fed.us/rmrs/docs/fourmile-canyon-fire/preliminary-findings.pdf.

Schultz Fire, Arizona, 2010.

Studies on how long beetle infested stands remain a crown fire hazard provide multiple benefits. Results not only offer insights into the potential use of fuel treatments in beetle-killed forests, but also increase firefighter awareness of dangerous situations and help managers identify areas at high risk for extreme fire behavior. You can learn more at [*Studies Illuminate How Pine Beetles Affect Wildfire.*](#)



The telltale red needles of a mountain pine beetle attacked tree contain 10 times less water than those of a similar healthy green tree, and these low moisture contents cause the red foliage to ignite quickly and easily. Even foliage from trees recently attacked but still visibly green ignited in significantly less time. This red-needle lodgepole pine tree was ignited on its lowest branches; the entire tree was quickly consumed in flames.

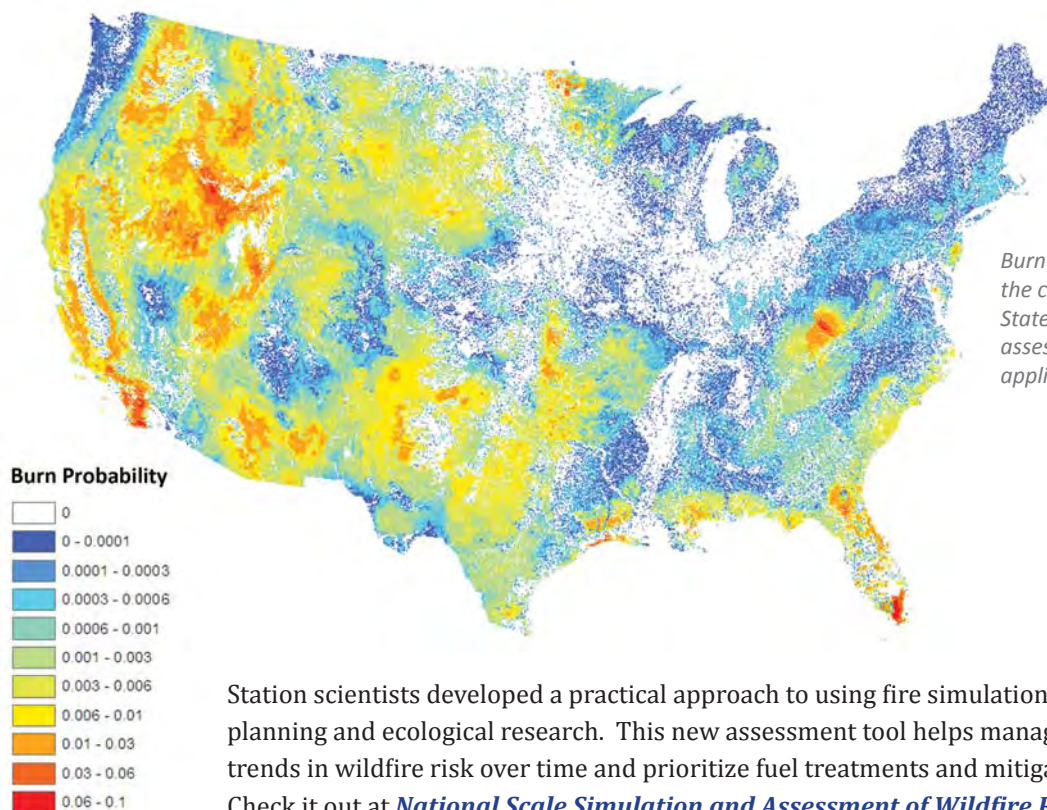


Research demonstrates the benefits of reviewing escaped fire reports and learning from them. Preliminary results suggest these reviews help improve safety-consciousness. Find out more at [*Using Reviews of Escaped Fires to Improve Organizational Learning.*](#)

Research is demonstrating the benefits of reviewing escaped fire reports and learning from them.

DID YOU KNOW?

Scientists have developed a 3-D fuel modeling system called FUEL3D that models wildland fuels from individual needles to landscape scales. This project helps improve our understanding of fundamental fire processes such as crown fires and the impacts of beetle killed fuels on fire, and for the first time enables us to examine how fires spread in complex fuels.



Burn probability map for the contiguous United States generated for risk assessment and other applications.

Station scientists developed a practical approach to using fire simulations for operational planning and ecological research. This new assessment tool helps managers monitor trends in wildfire risk over time and prioritize fuel treatments and mitigation measures. Check it out at [*National Scale Simulation and Assessment of Wildfire Risk.*](#)



Lab experiment showing flame wall apparatus sensor placement and close-up of turbulent eddies.

Studies at the Station's Fire Sciences Lab in Missoula, Montana, suggest a completely new approach to understanding and modeling fire spread. Researchers discovered that the ignition of wood depends on a critical rate of converting solid mass to combustible gas, and on heat flux and wind flow. Learn more about this exciting research at [*Understanding the Physical Processes of Fire Spread*](#).



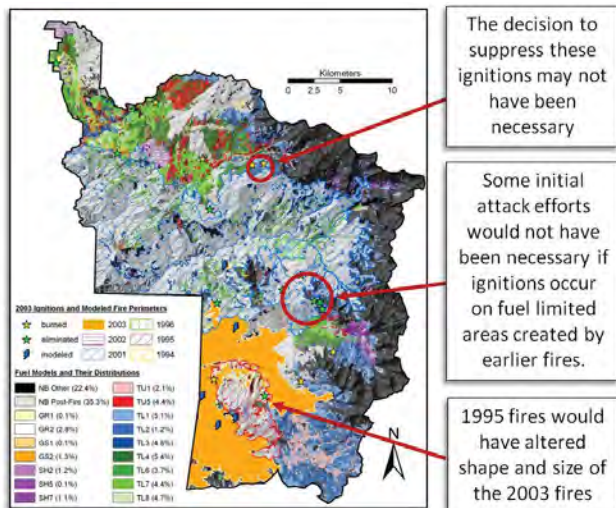
The Station's Wildland Fire Management Research, Development and Application program developed the Wildland Fire Decision Support System (WFDSS) that incorporates emerging science and technology into decision documentation, decision analysis, and long-term planning and implementation. Additional information is available at http://wfdss.usgs.gov/wfdss/WFDSS_Home.shtml or at [*Good Decisions for Good Fire Management*](#).

A number of factors interact to affect sound decision making in wildland fire management.

Study results from two major fires in Idaho provide solid evidence that effective fuel treatments generally do mitigate severe fire effects. The study also reviews and corroborates dozens of previous studies that support a widely held consensus among forest managers that forest thinning, followed by some form of fuels removal such as prescribed burning, is the most effective fuel treatment strategy. Learn more about this study at [*Can Fuel Treatments Mitigate Wildfire Effects*](#).



Thinned, piled and burned treated site, left photo, versus its paired untreated site one year later after a wildfire burned through both sites.



Simulations show where fires would have spread and reveal hidden consequences of suppression.

Station scientists recently analyzed the consequences of fire suppression. They found that the growth of many new fires can be curtailed by burned areas from previous fires. Studies illustrate that many ignitions will not occur because they are located in areas where an earlier fire left little fuel remaining on the site. This research improves the prioritization and planning of fuels management activities. Find out more at [The Hidden Consequences of Fire Suppression](#).

Station researchers investigated a number of fuel characteristics that comprise northern Rocky Mountain forest and range fuelbeds (see photos below). One finding shows that most fuel components have high variability that increases with fuel particle size. Results from this study have profound implications for fire management. Learn more at [Help with Mapping Fuel Characteristics](#).



Big Hole Valley (BV)
BLM land near Bannack, MT



Colville Forest (CF)
State land near Colville, WA



Lubrecht Forest (LF)
Lubrecht Experimental Forest, MT



Ninemile (NM)
Lolo National Forest, MT

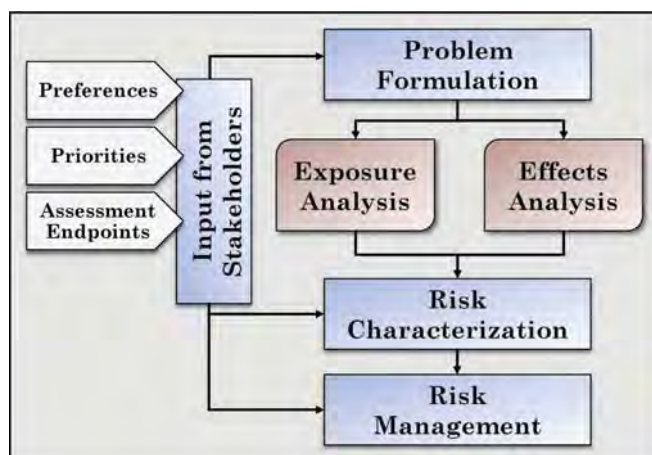


Silver Mountain (SM)
BLM land near Cedar City, UT



Tenderfoot Forest (TF)
Tenderfoot Experimental Forest, MT

The six sites selected for this study are located in Montana, Utah and Washington.



Scientists and cooperators developed novel methods to assess wildfire risk to communities, watersheds, wildlife habitat, and natural and cultural resources. These new wildfire risk assessment methods form the scientific basis for the National Cohesive Wildland Fire Management Strategy, an effort of federal, tribal, state and local governments to collaboratively address growing wildfire challenges. For additional information, visit [Assessing Wildfire Risk](#).

Key components of risk assessment are exposure analysis and effects analysis. This framework, employed by researchers, systematically portrays how fire likelihood and intensity influence risk to social, economic and ecological resources.

The Station's Science Application and Integration (SA&I) program facilitates the delivery and application of fire and other research. For National Fire Plan knowledge transfer, the approach is two-fold, addressing research that is currently underway, as well as highly relevant research that has already been completed. In Fiscal Year 2011, SA&I produced a series of briefing papers that describes ongoing research techniques, preliminary findings, and management implications. They are available at <http://www.fs.fed.us/rm/science-application-integration/national-fire-plan/>. Discover more at *Application and Delivery of National Fire Plan Research*.



Experiments at the Station's Fire Sciences Lab in Missoula, Montana provide critical information on fire behavior.

Science Application and Integration Program

National Fire Plan Research Highlight
July 1, 2011

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Birds and Fire

Since the mid 1990s, scientists from the USDA Forest Service, Rocky Mountain Research Station, have been studying the effects of fire on birds in ponderosa pine forests of the Interior West. This research aims to assist land managers as they consider options for forest restoration, fuels and fire management, and bird habitat creation and maintenance.

"This research has helped us assess project impacts to fire-associated woodpeckers and design projects based on their needs."

Are Fuels Reduction, Prescribed Fire, and Bird Habitat Compatible?

Although birds' responses to fire vary from tolerant to intolerant to neutral, many birds are dependent on fire landscape characteristics. Fire affects forest bird habitat in three major ways:

- Fire alters understory and overstory structure.
- Fire creates and destroys downed woody debris.
- Fire creates and destroys snags (standing dead trees).

Stand Structure

Stand structure largely determines the availability of roosting habitat, foraging habitat and food sources, and nesting habitat and nest sites for forest birds.

When a fire ignites, severity depends on habitat conditions preceding the fire—vegetation types, crown closure, and climate. Habitats are affected by the conditions following fire—

especially newly created snags, downed wood, and understory vegetation composition.

Downed Wood

Many insect foragers and ground nesters depend on downed wood for food sources and nesting habitat. Even low-severity fires can consume downed wood when fuel moisture is low. With fuel moistures less than 15 percent, fire generally consumes about half of the large downed wood. If maintenance of downed wood is an objective, it is important to burn while fuel moistures are high and fire severity projections are low.

Standing Dead Wood

Snags, especially those of large diameter, are very important as nest sites for cavity-nesting birds. They also provide roosting, nesting, and foraging habitat for a variety of wildlife. Fire can destroy snags, and many prescribed fire plans call for snag protection by removing combustible fuel near the snag base. However, this process is very labor intensive and we suggest using it only if large snags are rare or you are required to protect them. Instead, we found that prescribed fire can be an effective tool to create new areas of high snag density and snags of various sizes.



DID YOU KNOW?

Station researchers and cooperators developed the Fireworks education program for students in grades 1-10 to share the science of wildland fire. So far, over 2,000 students have been introduced to Fireworks, including those of the Blackfeet and Confederated Salish and Kootenai Tribes in Montana.

Briefing papers are one tool used to get science information to users.



Invasive Species

Invasive, or non-native, insects, diseases, plants and animals are some of the most serious environmental and economic threats facing our Nation. They often have no natural enemies and can cause extensive damage to natural resources, crops, urban landscapes, aquatic ecosystems, and the economies of communities and regions. Station researchers evaluate the threats caused by invasives, and develop methods to restore and rehabilitate impacted ecosystems. Research results provide land managers with knowledge and tools to help reduce or eliminate the potential for introducing invasives and their establishment, spread and impact throughout our Nations' public, tribal and private forests and rangelands.



The invasive cheatgrass is being studied by Station scientists.



Scientists with the Station's Grassland, Shrubland and Desert Ecosystems Science Program publish a popular newsletter called GSD Update that summarizes the latest scientific knowledge, technology and tools to help sustain and restore grasslands, shrublands, and deserts under increasing threats from expanding human-related uses, invasive species, changing disturbance patterns, and climate changes. You can view copies at <http://www.fs.fed.us/rm/grassland-shrubland-desert/products/gsd-update/>.

Recent issues include:

- The West in Transition: Costs and Unexpected Benefits of Disrupting Ecosystems
- Restoration on the Range: Healing America's Iconic Landscapes
- Invasive Species
- Checking the Range for Signs of Climate Change



Sampling a grassland site invaded by spotted knapweed in western Montana.

Researchers evaluated the effects of a common herbicide treatment on spotted knapweed in western Montana. They found that an aerial application of the herbicide picloram not only suppresses knapweed, but also increases the abundance of native grasses. Results such as this help managers maintain and restore grassland communities. Details are at [Broadleaf Herbicides Help Restore Grassland Communities](#).

Station scientists are investigating cheatgrass, an invasive plant affecting rangelands across the Intermountain West. They discovered that biocontrol using naturally occurring fungal pathogens is a valuable tool when used in conjunction with other control methods. One pathogen, dubbed the “Black Fingers of Death” (photo), shows promise in the control of weed seed banks in production agriculture as well as on rangelands. Learn more at [Black Fingers of Death](#).



Black, finger-like stromata, or fruiting bodies, of the seed pathogen dubbed Black Fingers of Death protrude from killed cheatgrass seeds.



By studying the chemical ecology of plants, scientists found that insects used in biocontrol of weeds affect weed chemistry in very different ways. They discovered that leaf- and root-chewing insects trigger weeds to produce huge amounts of defensive compounds, such as toxic chemicals in leaves, whereas galling insects, which live within abnormal plant growths, have little impact on weed chemistry. This emerging science provides valuable information regarding what types of insects are most likely to impact weed populations. Find out more at [Biological Control of Invasive Plants](#).

A caterpillar of the cinnabar moth serves as a biocontrol agent of invasive tansy ragwort. This insect induces large chemical changes in the host plant and has been used to dramatically reduce populations of this weed in the northwestern United States.

DID YOU KNOW?

Researchers are studying the effects of changing climates on exotic plants and the effectiveness of biological controls on these invaders. Invasive plants overrun natural systems at the expense of natives, and biological control represents a powerful tool for stemming the tide of invasion, but changes in temperatures and moisture are very likely to alter key interactions.

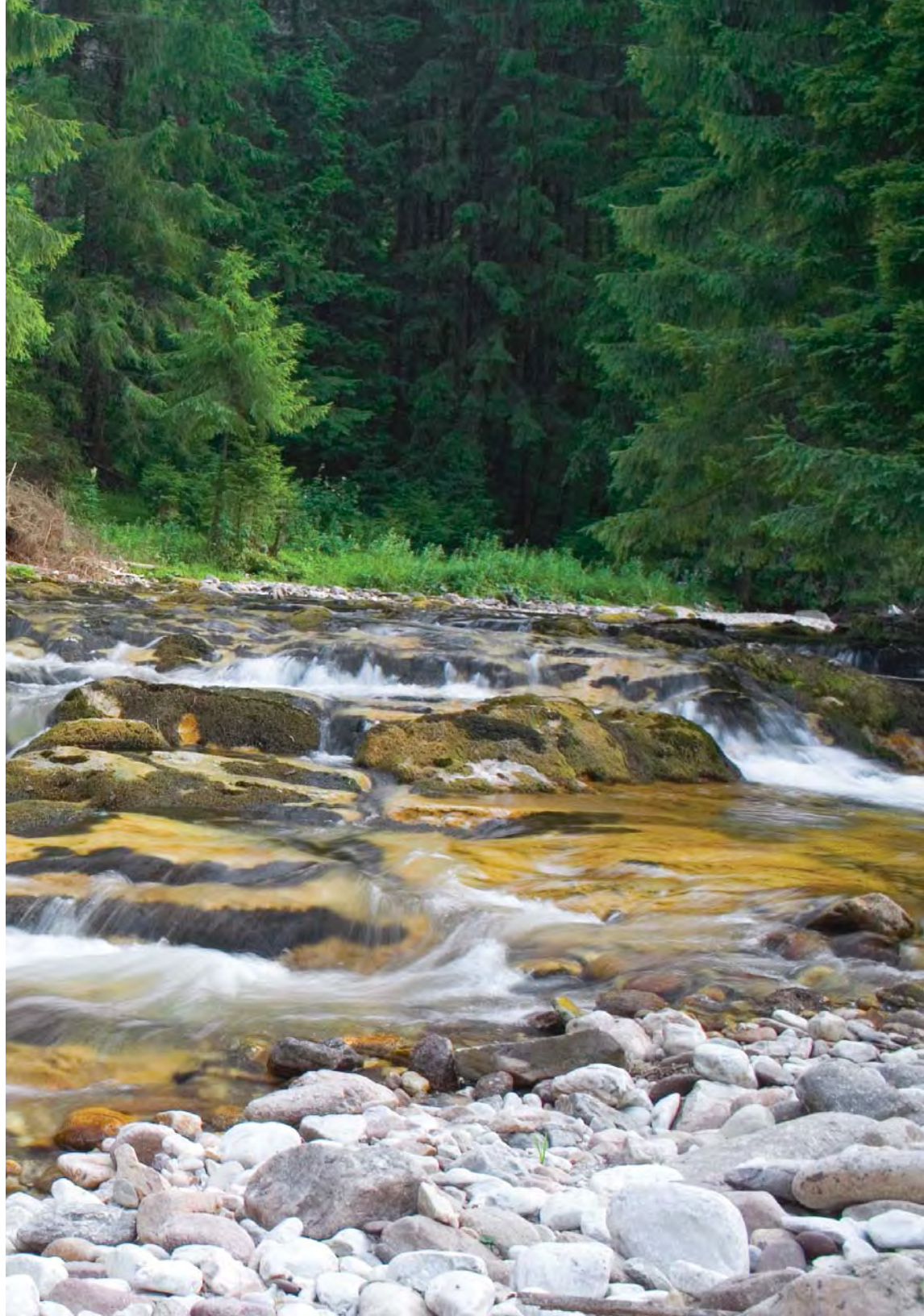


Water, Air and Soil

Land managers rely on sound science to help formulate decisions and advise policy makers and community leaders. Scientists supply technical tools, such as computer models and website databases, and are leaders in technology transfer in fire weather intelligence and smoke forecasts for the western United States. They also develop simulation tools that help maintain and restore western watersheds, and create methods for monitoring and improving soil conditions.



Sampling stream water.



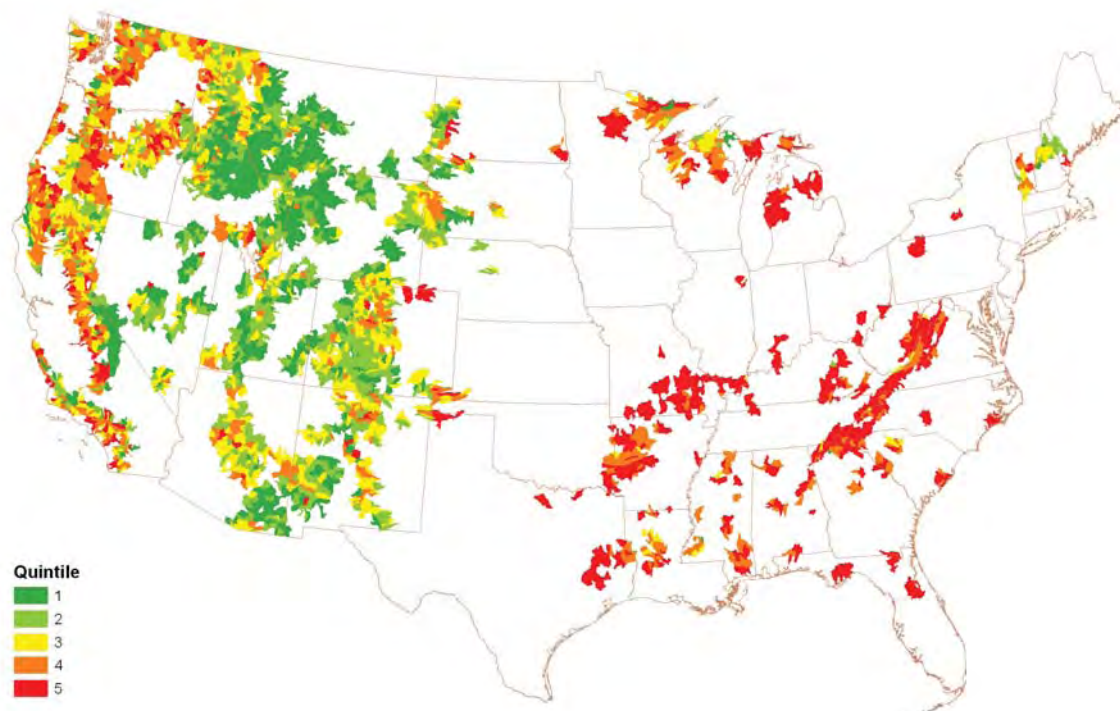
Station scientists developed a standardized forest soil monitoring protocol that uses visual classifications to describe the degree and extent of soil disturbance, and helps managers determine if those effects are detrimental to long-term site productivity. The Station published two field guides that describe the methods and statistics of soil monitoring, as well as a picture guide to the disturbance categories, and developed an on-line training curriculum. Learn more at [Protocols Improve Understanding of Changing Soils](#).

DID YOU KNOW?

In the Borderlands region of southern Arizona, researchers evaluate the impacts of cool- and warm-season prescribed burning and wildfire on oak savannas. This study is underway at the request of local private and public land managers who want to re-introduce fires into this ecosystem.

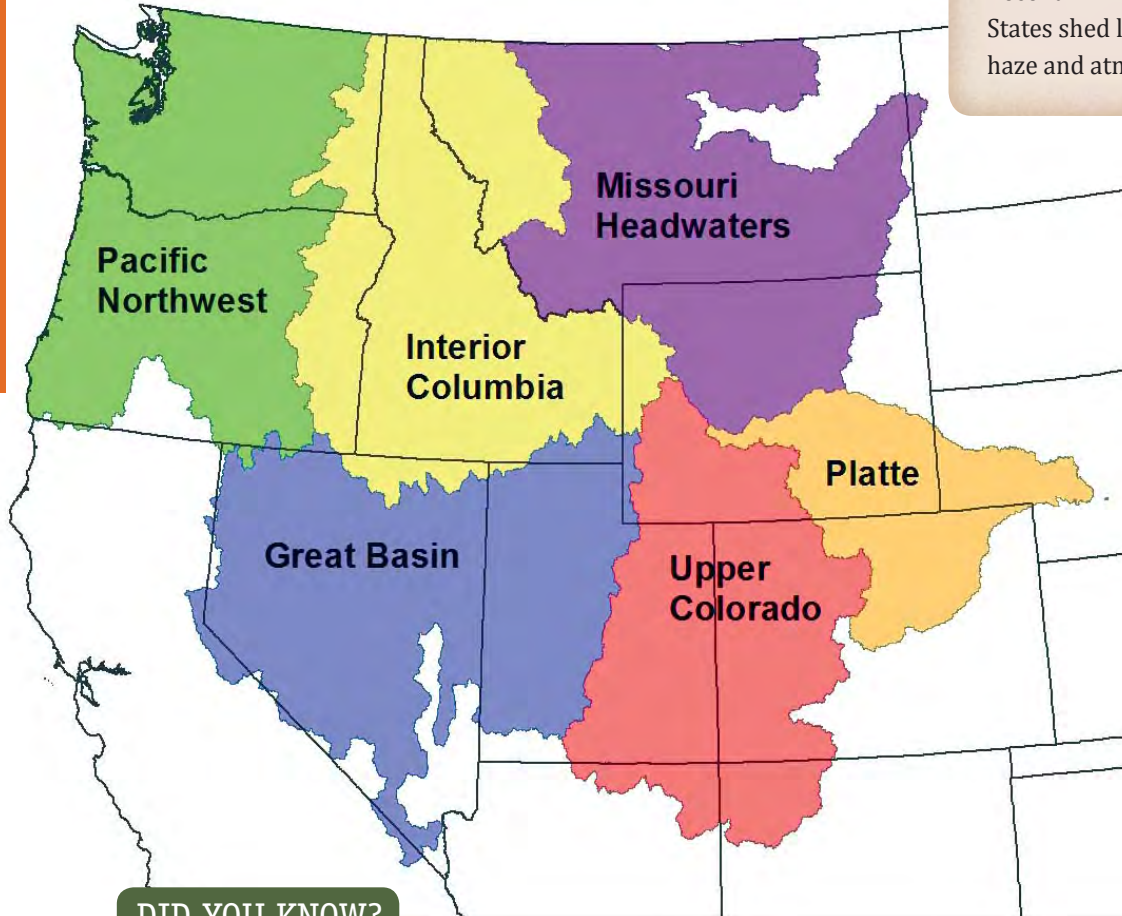


Training sessions help ensure that the Forest Soil Disturbance Monitoring Protocol is used consistently across national forests in the United States.



Given the importance of clean water to people and ecosystems, and the fact that much of our nation's water comes from our national forests, Station scientists sought to better understand how the risk of water pollution from nonpoint sources varies across the nearly 3,700 major watersheds in the U.S. containing National Forest System (NFS) lands. Findings show that the non-NFS watersheds are consistently under much greater stress than the NFS watersheds, but that the resources at risk are more evenly spread across the NFS and non-NFS areas. This research offers a starting point for decisions on risk mitigation efforts, and provides consistent data for use in national or regional watershed analyses. Additional information is available at [The Risks of Impaired Watershed Conditions](#).

The degrees of risk for non-wilderness National Forest System parts of 3,700 watersheds (1 = low risk; 5 = high risk).



DID YOU KNOW?

Recent RMRS studies on air pollutants emitted by wildfires in the western United States shed light on their impact on air quality, and their contribution to regional haze and atmospheric greenhouse gases.

Researchers developed a database of flow metrics for streams in the western United States under historical conditions and climate change scenarios. Datasets are available for the historical period from 1978 to 1997 and for future scenarios associated with global climate models. This information helps resource specialists better determine how climate change may alter stream flow regimes, both now and in the future. Details can be found at *[Evaluating the Effects of Climate Change on Streamflow](#)*.

Modeled flow metric datasets are organized by 6 major river basins in the western United States.

DID YOU KNOW?

A recent two-day workshop sponsored by the Rocky Mountain Research Station, US Geological Survey, Trout Unlimited, and the Great Northern Landscape Conservation Cooperative provided management professionals and scientists with a forum to demonstrate the integration of scientific results with new tools for managing aquatic ecosystems under climate change scenarios. Recordings and copies of the speakers' presentations are available on the workshop website www.fs.fed.us/rm/boise/AWAE/workshops/climate_aquatics_decision_support.shtml. Visit the new Climate-Aquatics Blog at <http://groups.google.com/group/climateaquaticsblog?hl=en> for discussions on the latest research and management tools for addressing climate change effects on aquatic ecosystems.

DID YOU KNOW?

Scientists provided training and technology to the Nez Perce Tribe in Idaho to help members inventory the impacts of forest road developments on Tribal watersheds. The Tribe used the information to help prioritize road restoration work.



Wildlife and Fish

Wildlife and fish research covers a broad array of terrestrial and aquatic species, including those listed as sensitive, threatened and endangered. Today's managers are challenged with conserving critical habitats while also managing for recreation, timber, fire, insect and disease outbreaks, noxious weeds, and other resource issues. Research is underway on habitat attributes needed to maintain species across complex and dynamic landscapes. Findings help protect and enhance wildlife and their habitats, and minimize or mitigate the effects from such disturbances as fire, urbanization, roads, recreation, invasives, climate change, and other factors.

Work is underway to evaluate the effects of fuel treatments on the population, survival and reproduction of the Mexican spotted owl. Study results are utilized to plan and implement restoration and fuels treatments in southwestern forests occupied by the threatened owl. For more information about this research, visit <http://www.rmrs.nau.edu/wildlife/>.

DID YOU KNOW?

The Station helps sponsor the Wildlife in Native Schools Program (WINS). Developed in cooperation with the Institute for Tribal Environmental Professionals and Northern Arizona University, this program helps tribal students in Arizona expand their understanding of natural resources and encourages them to consider environmental careers.



Scientists are studying the habitat needs of the Mexican spotted owl in the southwestern United States.





An increase in development can lead to habitat loss and fragmentation.

Research results provide natural resource planners, managers and scientists with methods to maintain biodiversity in the face of wildlife habitat fragmentation and loss. Find out more about these studies at [*Wildlife Habitats and Habitat Fragmentation*](#).

DID YOU KNOW?

Investigations are underway on the effects of a proposed wind energy project on greater sage grouse in Wyoming. If implemented, this will be the largest wind farm in the world, capable of meeting the electrical demands of approximately 25% of Los Angeles. This is considered a critical study, given the potential for future wind development.

To evaluate fire and fish population dynamics, Station researchers, in collaboration with the University of Montana, linked the landscape fire succession simulation model Fire-BGCv2 with a stream temperature model and trout growth models to predict changes in trout species distributions and productivity under various climate and fire regimes.

Learn more at [*Fish and Fire Dynamics in a Changing Climate*](#).

*Male bull trout in the East Fork Bitterroot River Basin.
(photo by Aubree Benson)*



DID YOU KNOW?

Studies helped Station scientists and cooperators establish the importance of spring snowpack to wolverine habitat. By combining this information with anticipated climate change scenarios, they projected that wolverine habitat will shrink and become more fragmented, but populations will persist in the contiguous United States. Learn more about wolverine research at <http://forestcarnivores.org/wolverine/>.





Resource Management and Use

Our work provides a scientific and technological base to sustainably manage and use forest resources and improve the standard of living and quality of life for current and future generations. Areas of research include:

- plant and soil science
- social science
- silviculture
- forest and range ecology, productivity and management
- forest and biomass products and utilization
- economics
- climate change.



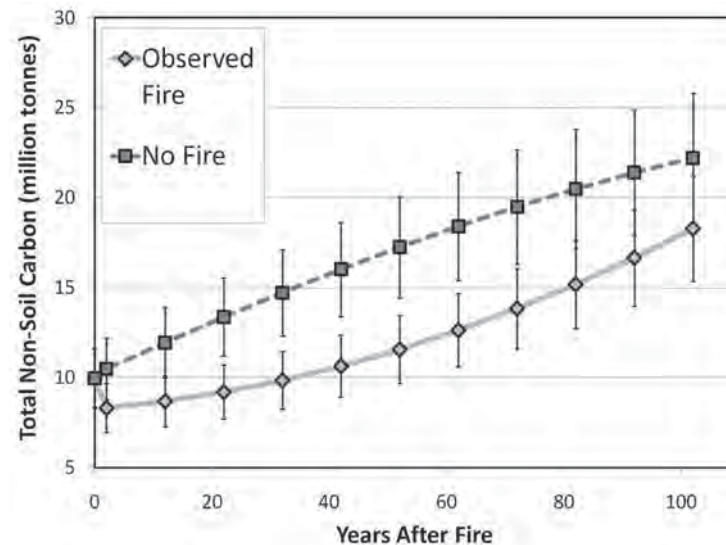


The cycle of generating biochar from beetle-killed trees.

Research is progressing on the feasibility of producing and using biochar, or biological charcoal, from residual materials left over following timber harvest or thinning. Several potential applications and markets for biochar exist, including as a soil amendment, a substitute for vermiculite in plant growing media, and in filters. Learn more about this exciting research at [Biochar from Biomass](#).

DID YOU KNOW?

Station researchers, in collaboration with NASA, developed the Forest Carbon Management Framework, a tool used by managers for a better understanding of carbon storage as it relates to patterns of timber harvest and natural disturbances.



New research by Station scientists developed a process to visualize how harvested and burned forest stands contribute to overall carbon storage over time. Called ForCaMF, or Forest Carbon Management Framework, it applies a stand-level forest carbon simulation tool – the Forest Vegetation Simulator (FVS) – spatially across vegetation and disturbance history maps. ForCaMF was piloted and implemented in the Northern Rockies as part of a project supported by NASA. Details can be found at [Visualizing Carbon Storage of Harvested and Burned Forests](#).

ForCaMF output showing non-soil carbon storage in all forests burned in Ravalli County, Montana, between 1999 and 2001. The 100-year projected carbon storage following observed fire patterns and intensities (solid line) is contrasted with storage associated with the same stands if no fire had occurred (dashed line).



The Station and its collaborators recently established a science-management partnership called the Interior West Climate Change Working Group to help proactively understand and address the impacts of changing climates across the diverse landscapes of the Intermountain West and Great Plains. Find out more about this group and its charter at [Group Addresses Climate Change Impacts](#).



In partnership with the Confederated Salish and Kootenai Tribes of Montana and the University of Leeds, UK, the Station is restoring and enhancing relationships between residents of the Flathead Indian Reservation of Montana and the Mission Mountain landscape within the reservation. This research increases the potential for protecting environmental and human well-being for future populations of people living on tribal lands. It also provides a foundation for creative approaches to addressing ecosystem health on the larger landscape, and paves the way for more collaborative work between the Tribes and the Forest Service. Read more at [*Understanding Climate Change Trends on Tribal Reservations*](#).

The Flathead Indian Reservation, located in western Montana, is home to the Bitterroot Salish, Kootenai, and Pend d'Oreilles Tribes - also known as the Confederated Salish and Kootenai Tribes of the Flathead Nation.

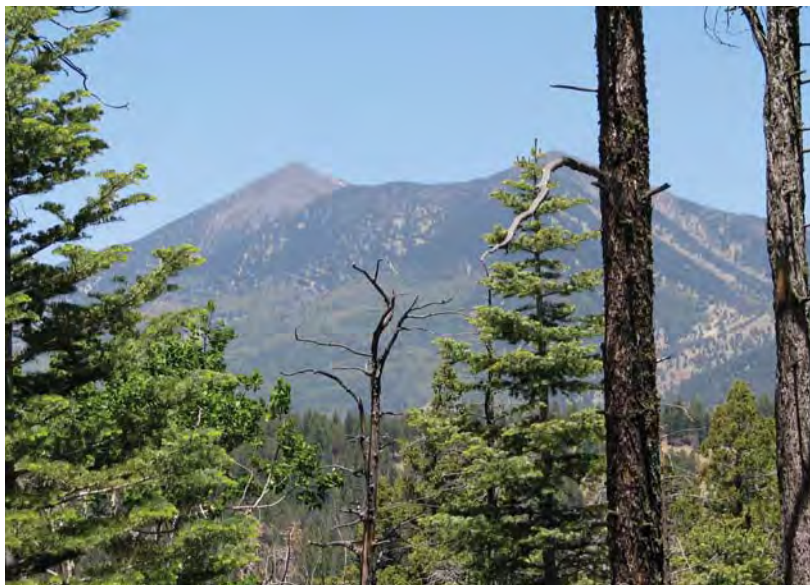
DID YOU KNOW?

Work is underway to develop treatments to restore whitebark pine forests. These important ecosystems are home to hundreds of wildlife species, yet their health and extent have been in decline for over 30 years. Learn more about whitebark pine research and management at <http://www.fs.usda.gov/detail/r1/plants-animals/?cid=stelprdb5341458>.

The Forest Service Reforestation, Nurseries and Genetic Resources (RNCR) Team transfers technology on native plants, including their collection, propagation and planting. The team works to ensure that nursery managers, reforestation and restoration specialists, and others in related fields receive the most state-of-the-art and timely information. Read about it at [*The Intersection of Science and Technology Transfer*](#).



RNCR specialists provide necessary on-site support to nursery managers to improve production of native plants for reforestation and restoration.



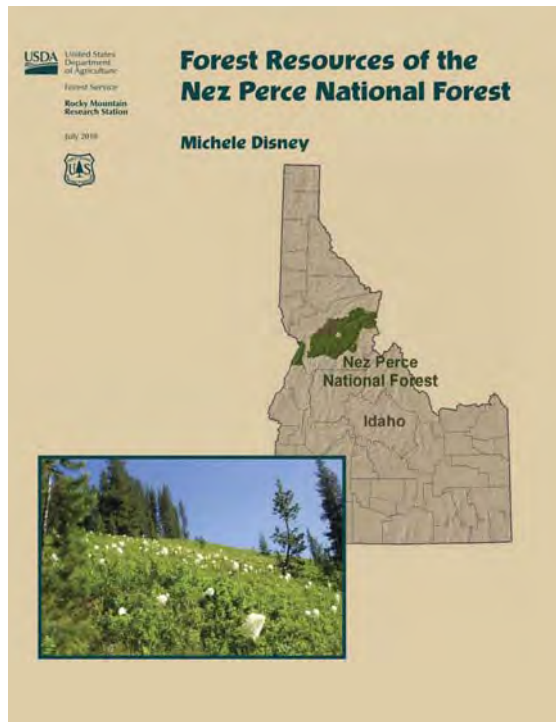
In 2010, the Station began a collaborative project with the Institute for Tribal Environmental Professionals, to better understand climate change issues and their impacts on ecosystems in the Southwest. The Project's goals are to: 1) identify existing climate change work underway by tribes in Arizona and New Mexico; 2) assess tribal research and information needs regarding climate change; and 3) develop strategies for meeting those needs. Find out what the partnership is doing to accomplish these goals at [*Southwestern Tribes - Collaborative Approach to Climate Change*](#).

The San Francisco Peaks in northern Arizona are sacred to many Native American groups.



Inventory and Monitoring

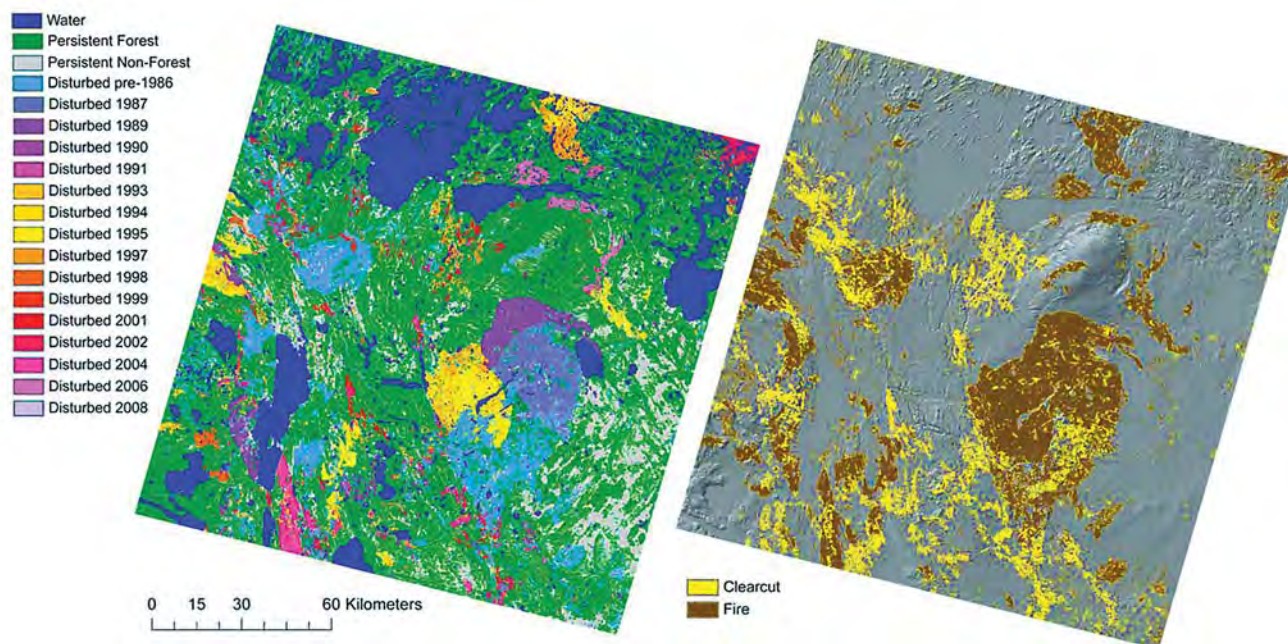
The Station maintains a comprehensive inventory and monitoring program that collects, analyzes and reports information on America's forests and rangelands. Such information helps assess the status, trends and sustainability of our forests, and is used by land managers, planners and policy makers to make informed resource management decisions.



Forest resource data collected by the Station's Inventory and Monitoring program are often published in reports for land managers and planners.

Station scientists use Landsat satellite data to map the causes of disturbance over large areas. Scientists use this information to better estimate area impacted, improve tracking of how vegetation recovers following fire or logging, and to enhance policy and management decisions. For more information, visit [*Mapping Wildfire and Clearcut Harvest Disturbances with Landsat Data*](#).

Landsat maps showing year and type of forest disturbance for a portion of boreal forest located in central Saskatchewan, Canada.



The Station's Forest Inventory and Analysis (FIA) specialists compare current forest inventories to historical inventory data. The results of these efforts put current inventory data in a historical context so that actual long-term trends in forest resources, including biomass and carbon, can be measured. More information is available at [*Idaho's Forest Biomass*](#).

Measuring tree height is one method used to compute biomass.



Outdoor Recreation

The Forest Service provides high-quality recreational experiences for the American public. The Nation's national forests, grasslands and wilderness areas see well over 200 million visitors annually. A rapid increase in visitor numbers affects the ability to provide the benefits people want without degrading the very resources they wish to visit. Through research, managers, communities and others can better understand the risks, trends and emerging issues affecting recreation, and new ways to meet recreation and ecotourism needs while protecting core ecosystem features and attributes.



DID YOU KNOW?

Researchers test ways to restore vegetation on highly-impacted subalpine campsites. Impacted campsites damage watersheds and detract from high-quality experiences. Without help, it may take many years for them to return to their natural state.



From 2007 to 2010, researchers, in cooperation with the University of Montana and Superior National Forest, conducted a study on visitors to the Boundary Waters Canoe Area Wilderness in Minnesota with some surprise findings. Learn what they were at [*Recreation Trends at the BWCAW*](#).

Studies found that visitors to the Boundary Waters Canoe Area Wilderness are older, mostly male, experienced, encounter more groups each day, and are more likely to conclude that there is crowding.

Researchers use in-depth interviews and community and visitor surveys to develop a good understanding of the ecological, economic, social and cultural values associated with wilderness dams. Findings show how visitors and local community members relate to or trade off these values in determining attitudes toward wilderness dams. Learn more at <http://leopold.wilderness.net/research/projects.cfm?catID=11&subcatID=29&subsubcatID=31&status=1&show=3#anchor>

A collaborative project with the National Park Service is resurveying over 7,000 backcountry campsites that were originally inventoried in the 1970's. The original inventory serves as a baseline against which to evaluate changes in impacts from dispersed backcountry use as a result in changes in management strategies and visitor use patterns. Details of can be found at <http://leopold.wilderness.net/research/projects.cfm?catID=11&subcatID=27&subsubcatID=33&status=1&show=3#anchor>.

Many Forest Service public recreation areas charge for permit reservations, use of campsites and vehicle parking. The effectiveness of the fee program, including public response to user fees is currently under analysis by Station researchers and cooperators. Results will help managers make decisions including how to collect fees, set prices, spend revenue, respond to visitor reactions to new fees, and determine how outdoor experiences may change as a result of fees. Learn more about this work at <http://leopold.wilderness.net/topics/recfees.htm>.



Fishing in a Colorado stream.



Science Application and Integration

Science application and delivery at the Rocky Mountain Research Station is achieved through the varied and diverse efforts of our individual scientists, technology transfer specialists within our seven science programs, key university partners, and a suite of communication, outreach and marketing efforts. Importantly, the Station has a dedicated staff group that focuses on knowledge exchange and transfer – assuring that Station science results and tools are available and accessible, and that land managers' needs and interests are incorporated into Station science priorities.

The Science Application and Integration (SA&I) staff includes two focused research development and application programs (RD&A): Human Factors and Risk Management, and Wildland Fire Management. Additional information about the SA&I program is available at <http://www.fs.fed.us/rm/science-application-integration>.



Field trips are one way to get the latest research findings to land managers and other users.

Key accomplishments include:

- Funded projects that make National Fire Plan research knowledge and technology more understandable and accessible to field practitioners.
- Initiated the Interior West Science-Management Connect – a peer network for researchers, practitioners and managers who are interested in science application and delivery. The network shares new learning opportunities, improves skills and solves problems, primarily through monthly webinars.
- Addressed climate change in the Interior West – During 2011, SA&I funded several climate change workshops and facilitated the Interior West Climate Change Working Group; hosted a workshop on aquatic ecosystems; and helped organize a science webinar to discuss climate change in the Great Plains.
- The Rocky Mountain Research Station and the Forest Service's Rocky Mountain Region produced a report, "Review of the Forest Service Response: The Bark Beetle Outbreak in Northern Colorado and Southern Wyoming," at the request of Senator Mark Udall. The report discusses the conditions that led to the outbreak, the Forest Service response, extension of legal authorities that help the agency respond to outbreaks, and what to expect as the forests regenerate. It is available at <http://www.fs.usda.gov/detail/barkbeetle/home/?cid=stelprdb5340741>.

DID YOU KNOW?

Station researchers are working with and serving tribal communities throughout the West regarding their needs for fire and fuels technology. The Station is part of four regional consortia for delivering fire and fuels science results to managers.



Long-Term Research at Experimental Forests, Ranges and Watersheds

A unique and valuable part of the infrastructure within which we conduct research is a network of experimental forests, ranges, and watersheds. They are living laboratories where Forest Service scientists conduct studies and demonstrate research results for our stakeholders. Experimental areas are some of the few places left where ecological research can be maintained over the long term – often longer than an individual scientist’s career. They are extremely varied and located throughout the United States and Puerto Rico.

The Rocky Mountain Research Station administers and conducts research on 14 experimental forests, ranges, and watersheds. The Fort Valley Experimental Forest, located near Flagstaff, Arizona, was established in 1908, and is the site of the first Forest Service research investigations in the Nation. Learn about on-going research at each of these experimental sites by visiting (<http://www.fs.fed.us/rm/main/expfor.html>).

(see next page)



Priest River Experimental Forest (Idaho)
<http://forest.moscowsl.wsu.edu/ef/pref/index.php>



Tenderfoot Creek Experimental Forest (Montana)
<http://www.fs.fed.us/rmrs/experimental-forests/tenderfoot-creek-experimental-forest/>

Coram Experimental Forest (Montana)
<http://www.fs.fed.us/rm/ecology/demo/coram/>

Black Hills Experimental Forest (South Dakota)
<http://www.fs.fed.us/rmrs/experimental-forests/black-hills-experimental-forest/>

Deception Creek Experimental Forest (Idaho)
<http://www.fs.fed.us/rmrs/experimental-forests/deception-creek-experimental-forest/>

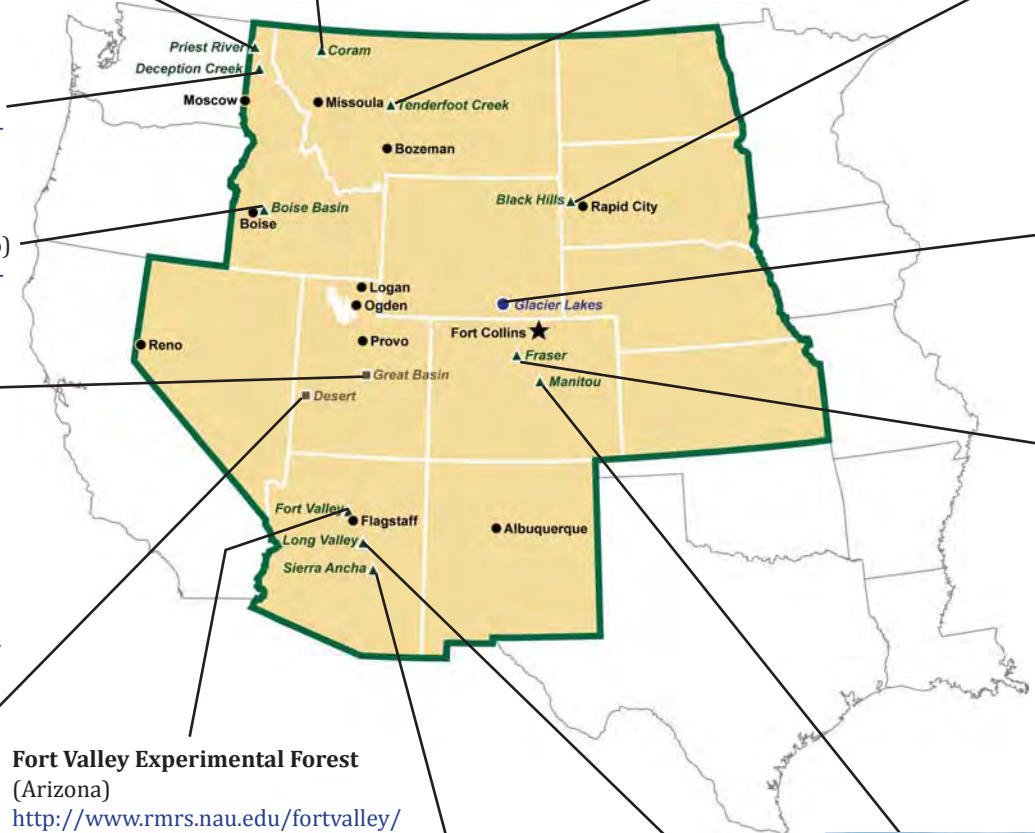
Boise Basin Experimental Forest (Idaho)
<http://www.fs.fed.us/rmrs/experimental-forests/boise-basin-experimental-forest/>



Great Basin Experimental Range (Utah)
<http://www.fs.fed.us/rmrs/experimental-forests/great-basin-experimental-range/>



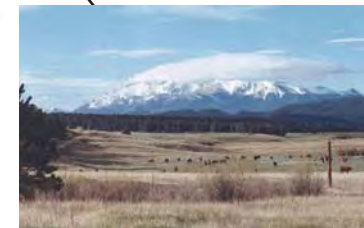
Desert Experimental Range (Utah)
<http://www.fs.fed.us/rmrs/experimental-forests/desert-experimental-range/>



Glacier Lakes Ecosystem Experiments Site (Wyoming)
<http://www.fs.fed.us/rm/landscapes/Locations/Glees/GLEES.shtml>



Fraser Experimental Forest (Colorado)
<http://www.fs.usda.gov/efr/fraser>



Manitou Experimental Forest (Colorado)
<http://www.fs.usda.gov/efr/manitou>



Sierra Ancha Experimental Forest (Arizona)
<http://www.fs.fed.us/rmrs/experimental-forests/sierra-ancha-experimental-forest/>

Long Valley Experimental Forest (Arizona)
<http://www.fs.usda.gov/longvalley>

Research Natural Areas: Conserving Biological Diversity

The Rocky Mountain Research Station (RMRS) oversees activities on 273 Research Natural Areas. These areas represent a variety of habitats and ecosystems from alpine to lowlands, and from coniferous forests of the Northern Rockies to semiarid deserts of the Southwest and prairies of the Great Plains.

The Research Natural Areas within our territory offer an unprecedented opportunity to investigate natural resources in an unspoiled and protected environment. They were selected and are managed in cooperation with National Forest System managers as the best possible representatives of major habitat types, or for unique ecological, botanical, geological, or hydrological features.



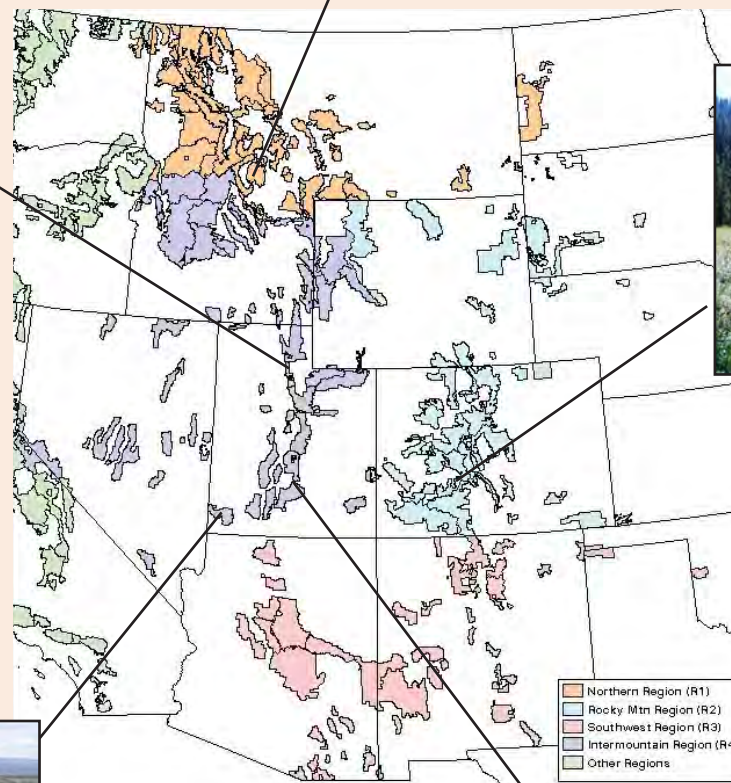
*Butler Fork Research
Natural Area, Utah.*



*Shoofly Meadows Research
Natural Area, Montana.*



*Gothic Research
Natural Area,
Colorado.*



*Desert Range Research
Natural Area, Utah.*

*Research Natural Areas within
the Rocky Mountain Research
Station territory.*



*Elk Knoll Research
Natural Area, Utah.*

Additional information is available on our website at www.fs.fed.us/rmrs/research-natural-areas.



Conservation Education

The Station's Conservation Education program helps people of all ages understand and appreciate our country's natural resources and how to conserve those resources for future generations. Our employees are involved in a variety of structured educational programs and activities that enable people to realize how natural resources and ecosystems affect each other and how resources can be used wisely.

Following are a few examples of Conservation Education activities the Station sponsored in 2011.



WSU students learn about water erosion research at the Moscow, Idaho lab.

- ▲ The Station's Moscow, Idaho, laboratory hosted students from a Washington State University Civil Engineering Hydraulics class. Scientists presented an overview of their work and led teams of students in practical applications of hydraulic engineering fundamentals related to water erosion research.

- ▼ Kids in Nevada participated in the 3rd Annual Spring Mountains Science Safari. The Safari, a collaboration between RMRS, the Spring Mountain National Recreation Area, and the Humboldt-Toiyabe National Forest, provides a rich outdoor science education opportunity for kids to learn how all the elements of an ecosystem are interdependent.



At the Science Safari, students investigate the various elements of an ecosystem.



High school students learn how scientists measure snow depth.

- ▲ Scientists in Idaho partnered with high school students on a research venture that began in September 2010 and ended in May 2011. Once a month, the class collected ponderosa pine tree core and soil samples to determine how the forest's uptake of water affects groundwater recharge. In March, the scientists also conducted a snow lab allowing the students to use snow samplers to determine depth, density.

In an article recently written by Safiya Samman, Director of the US Forest Service Conservation Education Program, titled "Unplugging America's Children," she notes that "Today more young people are growing up with an urbanized lifestyle that keeps them indoors and plugged into electronics rather than meeting nature face-to-face. They spend 50 percent less time outdoors than their counterparts did 20 years ago." She goes on to say that "... children who spend time outdoors are more likely to become environmentally conscious adults. By engaging children in outdoor activities, America is nurturing tomorrow's environment stewards."



As part of the Flagstaff in the Woods Program, children search for insects under a rotting log.

▲ Flagstaff (AZ) in the Woods Program, funded by the national More Kids in the Woods 2011 program, is a multifaceted outdoor environmental education program. Sponsored by the Station, the Coconino National Forest and Willow Bend Environmental Education Center, this five-part program is designed to provide members of the Flagstaff community with the inspiration to be outdoors and the opportunity to learn about their environment.

▼ The Station's Air, Water and Aquatic Environments Technology Transfer Program participated in the 2nd annual Face to Fish Days at Idaho Fish and Game's Morrison Knudsen Nature Center. Kids and their parents enjoyed streamside walks and aquatic education lessons taught by biologists through the use of a stream simulator and tribal fisheries history tales.



Station researchers teach children about aquatic biology during Face to Fish Days.

- Seventh and eighth graders in Espanola, New Mexico, learned about the use of radio telemetry to assist researches in various raptor studies. Researchers helped the students experiment with the equipment and get a taste of raptor telemetry techniques first-hand.



Forest Service officials, including Smokey Bear, join in Tu B'Shevat festivities.

▲ The Station joined nearly 1,000 people who celebrated Tu B'Shevat, the Jewish "Birthday of the Trees," in Tempe, Arizona, this year with a tree planting event. The Forest Service is the primary sponsor of the event and has more than 20 years of cooperation with the National Jewish Fund, which oversees forestry and most land management in Israel.



Students observe trout in a tank as part of the Trout in the Classroom program.

- ▲ In Boise, Idaho, our researchers helped teach over 1,000 students in 30 classrooms from K-12 about the biology and ecology of aquatic organisms and the importance of clean water, through a program called “Trout in the Classroom.” Students raised trout from eggs in the classrooms, dissected fish, met local fish biologists, measured water quality, and then released fish into the river.

“Thank you so much for the wonderful presentation that you prepared for our fourth graders here at Riverside. You were a BIG hit! It was great to see you dressed in your snorkeling gear! You explain your job and show great pictures of scientists actually doing a job that not many people get to do. Your presentation really helps them to understand fish habitat. We all appreciate your time and your efforts to help our students understand these important science concepts. . . Thank you for helping our Trout in the Classroom project to be so successful.”

4th grade teacher, Riverside Elementary

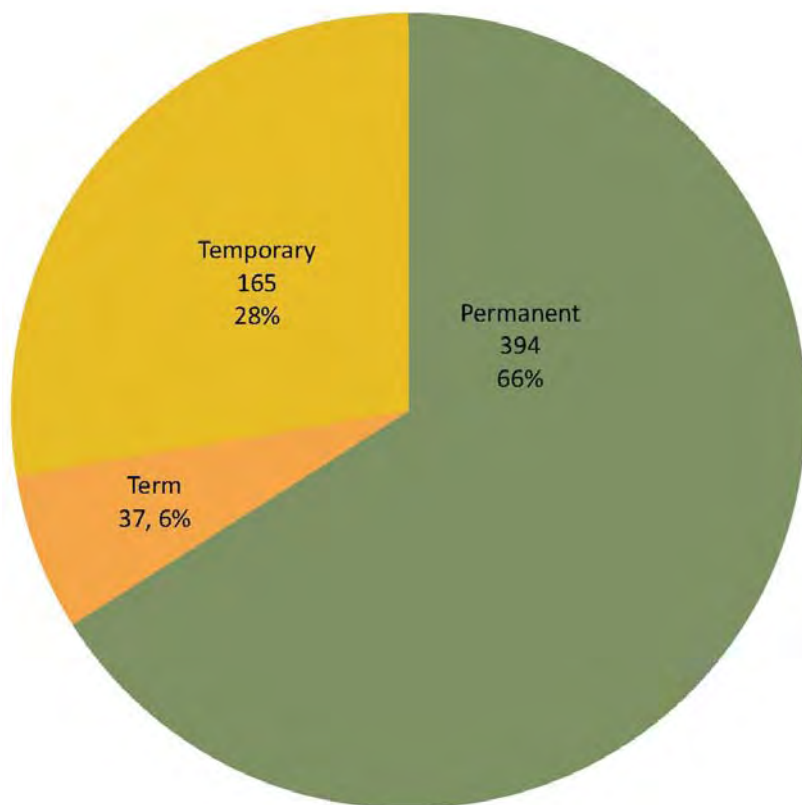


Kids' activities are a big part of the Flagstaff Festival of Science.

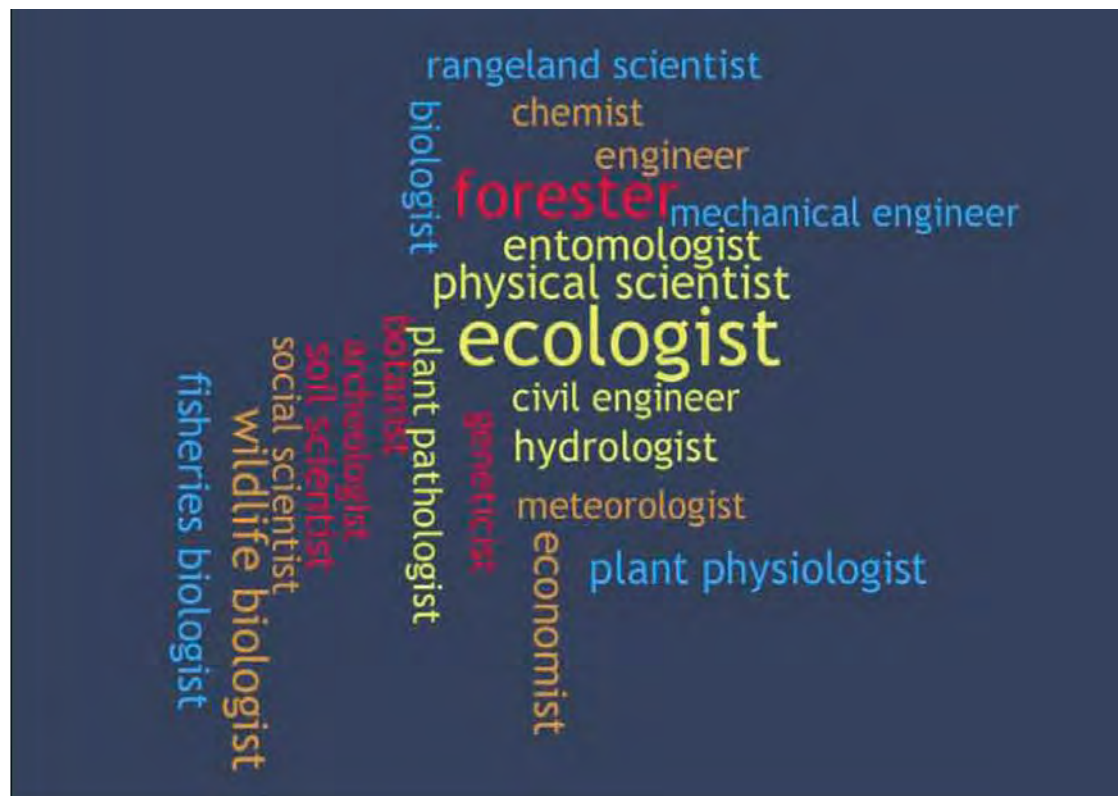
- ▲ The Flagstaff Festival of Science, one of the longest running science festivals in the country, celebrated its 22nd season in 2011. The Station's Flagstaff, Arizona laboratory has participated in the festival for over 12 years. This year, the lab hosted an open house at the Fort Valley Experimental Forest where scientists engaged kids in interactive bird activities, entertained with a birdfeeder webcam and wildlife tracks game, and provided guided tours of the site. The scientists also participated in the In-school Presentations program which partners with the Flagstaff Unified School District, Charter and Home Schooled Communities of Flagstaff to promote science awareness. One sixth-grader exclaimed, “So, you actually get paid to do this kind of stuff?”

At the Rocky Mountain Research Station, our people are our most important asset – an efficient and productive workforce which excels as leaders in caring for the land and serving people. During 2011, many of our employees were recognized with Forest Service, national and international awards and recognitions for their superior performance, contributions and professional achievements.

FY11 RMRS Workforce by Appointment Type



OUR PEOPLE



The Station's Fiscal Year 2011 workforce was comprised of over 550 permanent, term and temporary employees, complemented by an additional suite of contract employees that enhance our service capability. RMRS continues to emphasize the value of diversity in the workforce. In FY2011, we provided education seminars and celebrated Hispanic, American Indian, African American Heritage and Disability Awareness months with invited speakers, potlucks and other events. We also significantly increased our efforts to recruit a diversity of candidates.

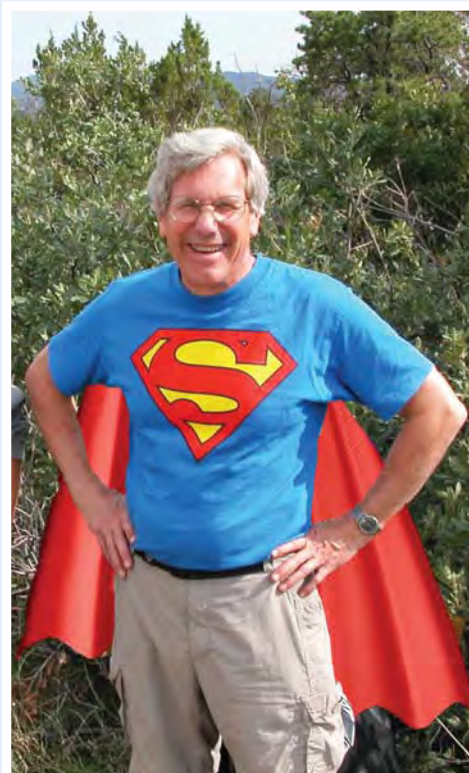
Research Ecologist

Michael Ryan, based at Station headquarters in Fort Collins, Colorado, recently attained Senior Level Scientist – an honor that only 19 of 482 current Forest Service scientists have garnered. These “Super Scientist” appointments are recommended by a national science panel, approved at the USDA level, and are based on a series of strict qualifying factors.

Ryan is noted for his substantial contributions toward understanding:

- the decline in tree and forest productivity with stand age
- the role of tree and ecosystem respiration in controlling plant and ecosystem carbon balance
- the role of disturbance in regulating landscape carbon balance.

He is recognized by his peers as among the world’s top ecologists. In 2007, he shared in the Nobel Peace Prize as a co-winner with former Vice President Al Gore and other scientists for his work on the Intergovernmental Panel on Climate Change (IPCC-1). You can learn more about Michael Ryan, his work and his publications at <http://www.fs.fed.us/rm/forest-woodland/profiles/?last=Ryan&first=Michael+G>.



Other employees that were awarded and recognized in 2011 include:



Dean Pearson



Sam Cushman



Dan Isaak



Kerry Overton



David Cole

- Supervisory Foresters **Bill Dunning**, **Dave Herwig** and **Jim Dexter**, along with Supervisory Ecologist John Capuano, received the Forest Service’s Quantitative Sciences Director’s Award for FIA (Forest Inventory and Analysis) Excellence.
- Research Forester **Matthew Thompson** garnered the ENRE (Energy and Resources Subcommittee) Forestry Best Presentation Award from the Institute for Operations Research and Management Sciences.
- Research Ecologist **Dean Pearson** was honored by the National Academy of Sciences as a Kavli Fellow.
- Research Landscape Ecologist **Sam Cushman** is co-author of a paper that received an Outstanding Paper in Landscape Ecology – Honorable Mention award by the U.S. International Association of Landscape Ecology.
- Research Ecologist **Jeanne Chambers** received the Forest Service’s National Rangeland Research and Development Award for 2010.
- The Society of Range Management presented its Outstanding Achievement Award to Research Range Scientist **Robin Tausch**.

Jeremy Pinto

- Fisheries Biologists **Dan Isaak** and **Kerry Overton** were recipients of the Forest Service's 2010 Rise to the Future Awards.

*Kas Dumroese*

- Research Geographer **David Cole** was honored with the George Wright Society's Natural Resources Achievement Award.

Alan Watson

- Botanist **Jeremy Pinto** and Research Plant Physiologist **Kas Dumroese** received the Forest Service's 2010 National Tribal Relations Professional Excellence Award.

*Russ Graham*

- Research Social Scientist **Alan Watson** received a Forest Service Honorable Mention Tribal Professional Excellence Award.

- Research Range Ecologist **Jack Butler** received the Grassland Research and Technology Award from the National Grassland Council.

Linda Joyce

- The Society of American Foresters presented its Award in Forest Science for 2011 to Research Forester **Russ Graham**.

*Deborah Finch*

- Quantitative Ecologist **Linda Joyce** and Program Manager **Deborah Finch** represented the Forest Service on a team that was honored with the Interior Department's 2011 Partners in Conservation Award.

The Station presented its Outstanding Publication and Administration awards for 2011. They include:

- Best Scientific Publication – Atmospheric Scientist **William Massman**.
- Technology Transfer Publication – Program Manager **William Block**
- Early Career Scientist Publication – Research Geneticist **Bryce Richardson**
- Visionary Science Publication – Research Ecologist **Michael Schwartz**
- Mid-Career Scientist Publication – Research Landscape Ecologist **Samuel Cushman**
- Eminent Science Publication – Operations Research Analyst **Nicholas Crookston**
- Outstanding Science Support – Ecologist **Jonathan Dudley**
- Outstanding Leadership Team Support – Program Specialist **Barbara Walters**
- Outstanding Program Support – Administrative Support Assistant **Frankie Martinez**
- Outstanding Lab Support – Business Manager **Shari Kappel**
- Outstanding Administrative Support – Program Assistant **Angie Harris**
- Outstanding Customer Support – Library Technician **Carin Clay**
- Customer Appreciation – Research Plant Ecologist **Carolyn Sieg**
- Early Career – Biological Technician **Elizabeth Rosenberger**
- Open Category – IT Support **Rob Lankston**
- Outstanding Safety Team – Hydrologist **Sue Miller**, Business Manager **Peggy LaMunyan**, Facilities Manager **Richard Tucker**, Biological Science Technician **Joanne Tirocke**, Forester **John Byrne**, Biological Science Technician **John Hanna** and Forester **Bob Denner**
- Outstanding Civil Rights Award – Research Ecologist **Paulette Ford** and Research Social Scientist **Alan Watson**

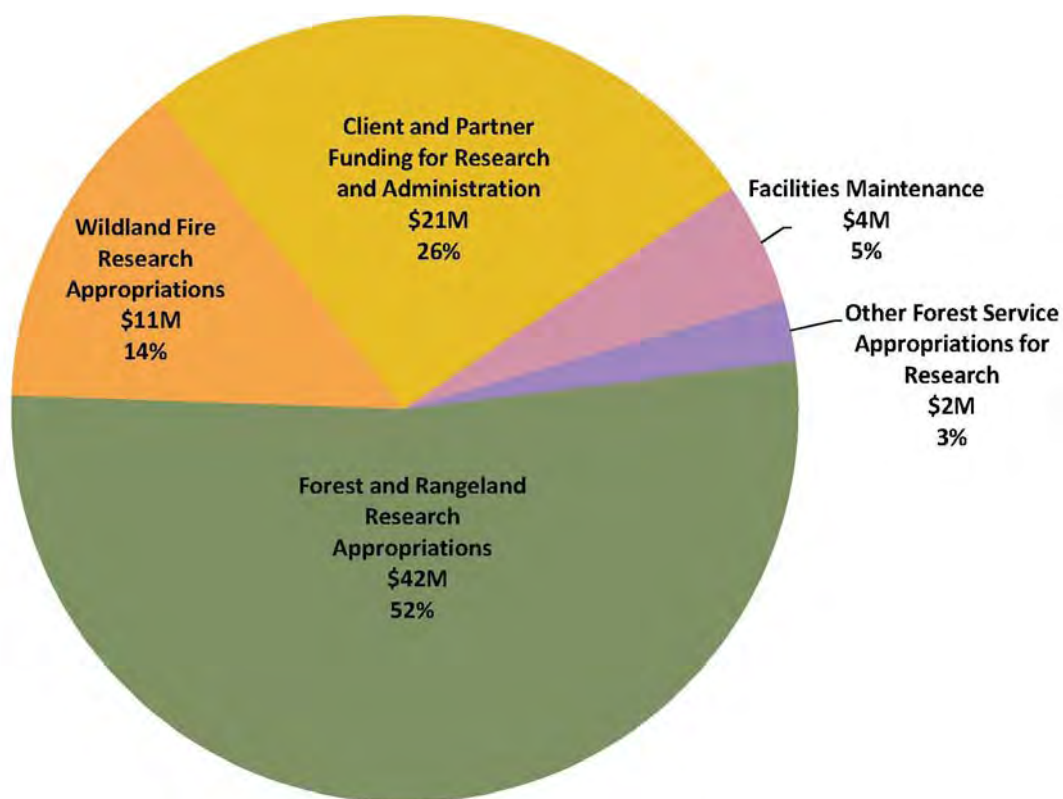
OUR BUSINESS

The success of our research programs would not be possible without the critical team support provided by our administrative employees. Most are located at Station headquarters in Fort Collins, Colorado, and at the Ogden, Utah Service Center; others work at laboratory locations.

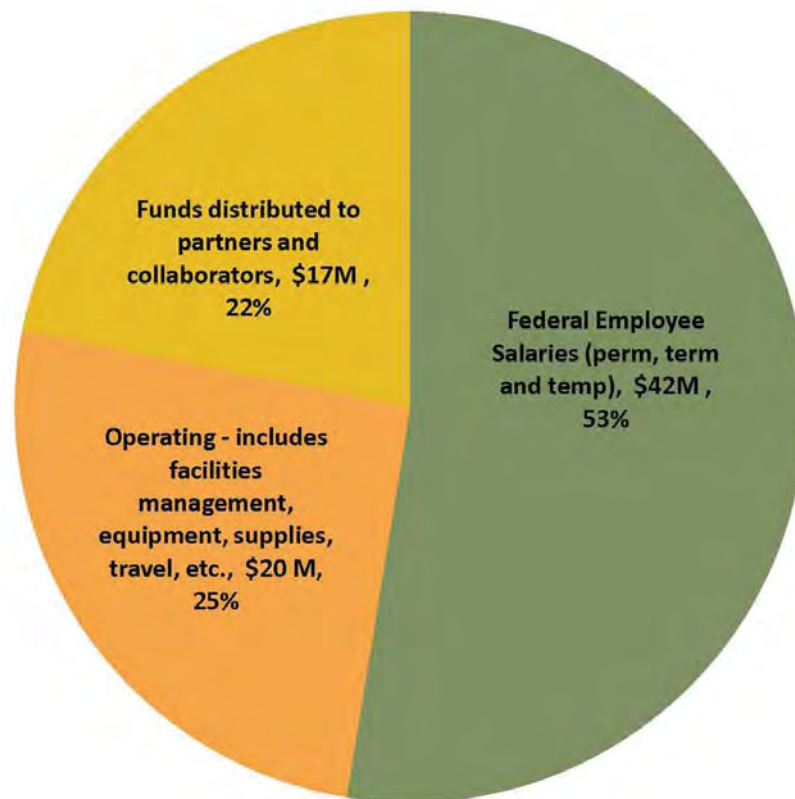
Budget

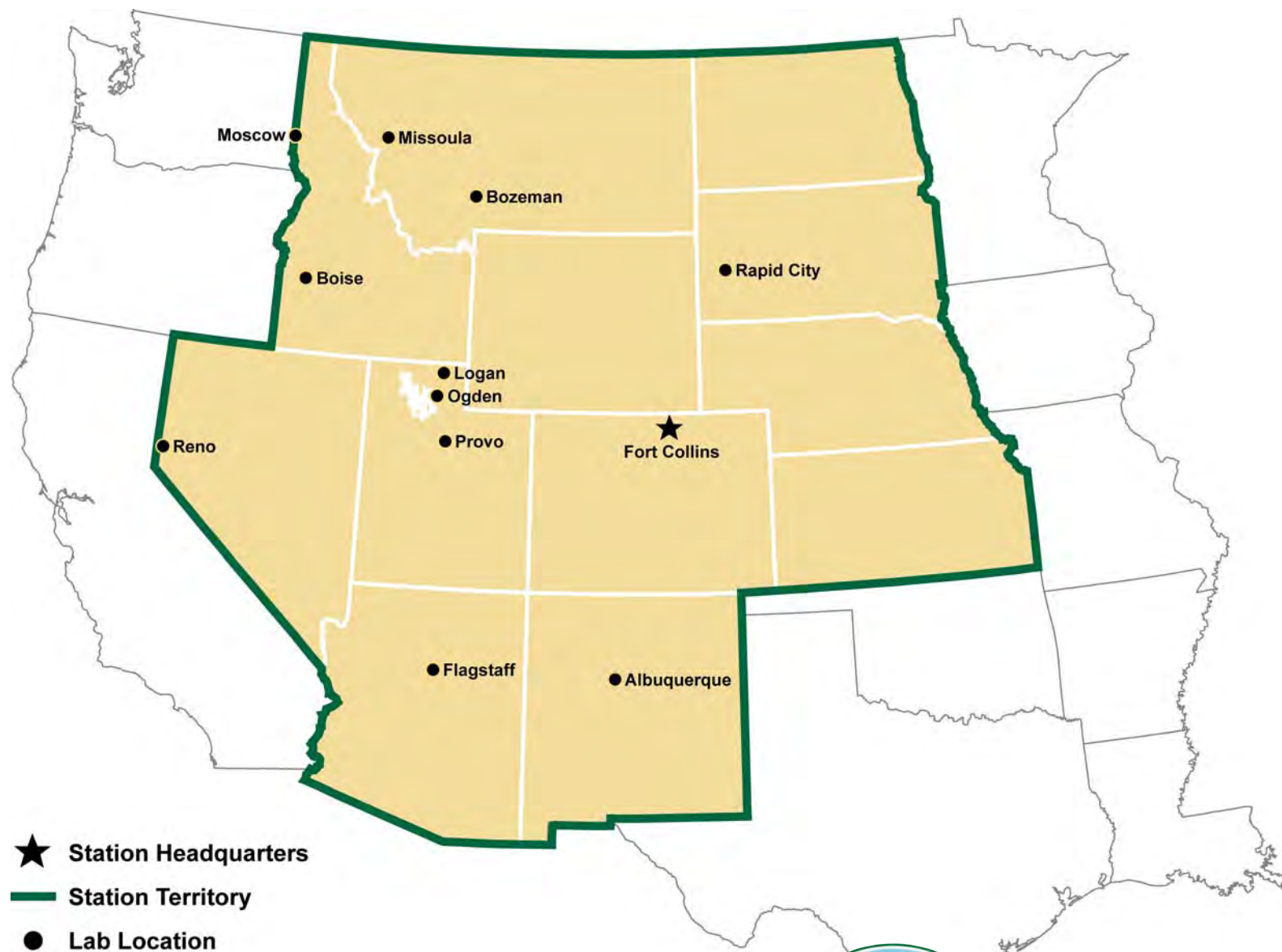
In Fiscal Year 2011, RMRS secured \$80 million for research and operations from federal appropriations, partners and clients. This funding supports a diverse portfolio of research. Through formal agreements, RMRS shared 22 percent (\$17.6 million) of our total budget with these partners. Of our total budget, federal salaries account for 53 percent (\$42.4 million) of expenditures and our operations for 25 percent (\$20 million).

FY11 Incoming Funds



FY11 Expenditures





USDA FOREST SERVICE
www.fs.fed.us/rmrs

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