



The Future of Fire Sciences

Missoula Fire Sciences Laboratory



Rocky Mountain Research Station

USDA Forest Service

September 2010





Rocky Mountain Research Station's Mission Statement

The Forest Service Research and Development mission, to **“develop and deliver knowledge and innovative technology to improve the health and use of the nation’s forests and rangelands,”** guides the work we do. Our priorities are to:

- ◆ Create credible, innovative, science-based solutions for resource management problems.
- ◆ Identify relevant needs and quickly and efficiently convert science gaps into findings and products for managers and citizens.
- ◆ Anticipate and respond to emerging issues.
- ◆ Enhance the ability of our customers and partners to more easily find, participate in, and use products of the RMRS research program.



Missoula Fire Sciences Laboratory, Fire, Fuel and Smoke Science Program Charter and Mission

The Fire, Fuel, and Smoke Science Program of the Rocky Mountain Research Station is chartered to:

- Conduct fundamental and applied research relating to wildland fire processes, terrestrial and atmospheric effects of fire, and ecological adaptations to fire.
- In addition, the Program develops associated knowledge tools and applications for both scientists and managers.
- The scope of work addresses four stages of wildland fire, including: the pre-fire environment; combustion and fire behavior processes; immediate (first-order) fire effects; and longer-term (second-order) fire effects.

Our Fire Sciences Lab’s Mission?

To improve the safety and effectiveness of fire management through the creation and dissemination of basic fire science knowledge.

Wildfires and Fire Research

Wildfires are a growing natural hazard in most regions of the United States, posing a threat to life and property, particularly where native ecosystems meet developed areas.

However, because fire is a natural and often beneficial process, fire suppression can lead to more severe fires due to the buildup of vegetation, which creates more fuel.

In addition, the secondary effects of wildfires, including erosion, landslides, introduction of invasive species, and changes in water quality, are often more disastrous than the fire itself.

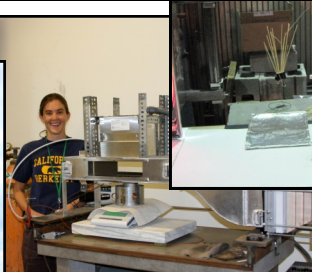
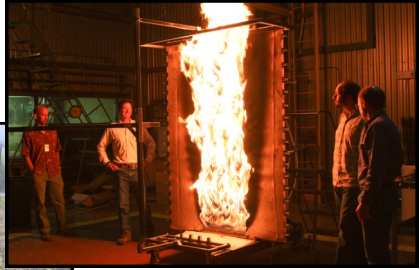
The USDA Forest Service, in conjunction with many other partners, provides tools and information to:

- ◆ identify wildfire risks and ways to reduce wildfire hazards,
- ◆ provide real-time firefighting support, and
- ◆ assess and mitigate the aftermath of wildfires.

The goal is to build more resilient communities and ecosystems.

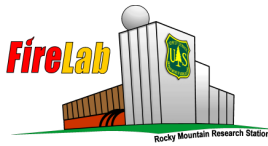


Fire Research --



-- At Work

Missoula Fire Sciences Laboratory



The **Fire, Fuel, and Smoke Science Program (FFS)** of the Rocky Mountain Research Station is located at the Missoula Fire Sciences Laboratory in Missoula, Montana. The staff includes world renowned scientists in addition to wide-ranging and accomplished support personnel.

This Program ...

- ◆ Conducts international, cutting edge work in wildland fire research from fire physics to fire ecology.
- ◆ Performs work under its national charter to conduct fundamental and applied research relating to wildland fire processes, terrestrial and atmospheric effects of fire, and ecological adaptations to fire.
- ◆ Develops associated knowledge tools and applications for both managers and scientists.

People at the Missoula Fire Sciences Laboratory

Natural Sciences:

Forester
Biologist
Botanist
Ecologist

Engineering:

Electrical Engineer
Mechanical Engineer
Civil Engineer

Physical Sciences:

Physicist
Chemist
Meteorologist
Atmospheric Scientist
Atmospheric Physicist
Remote Sensing Scientist

Computing and Analysis:

Computer Analyst
GIS Analyst
Software Engineer
Mathematician
Statistician

Technology and Information Transfer:

Technology Transfer Specialist
Technical Information Specialist
Technical Writer
Editor

Administration:

Program Manager
Program Specialist
Management Analyst
Project Manager
Program Assistant
Office Assistant
Budget Analyst

Fire Science Focus Areas

Original research at the Missoula Fire Sciences Laboratory includes:

- fire behavior prediction modeling
- soil heating modeling and effects
- landscape fire ecosystem dynamics
- smoke emissions and dispersion modeling
- fire danger rating.



The Fire, Fuel, and Smoke Science Program activities are cross-cutting, with considerable integration among six Focus Areas.

1. **Physical Fire Processes**- We analyze the combustion process and the factors that determine fire behavior. Increased understanding of combustion helps managers and society anticipate:

- potential for high intensity fire
- initial fire effects
- effects of fuel treatments
- potential for loss of life and destruction of property.

2. **Fuel Dynamics** - Research on fuel dynamics helps managers describe the vegetation that burns during wildland fires. Improved information about fuels, including their patterns of change over space and time is used to predict seasonal and multi-year changes and more accurately predict fire behavior and fire effects.

3. **Smoke Emissions and Dispersion** - We use field observations, satellite data, and models to describe smoke's composition, its movement within a fire's heat plume, and its movement through the layers of atmosphere. This knowledge helps to better understand the health concerns associated with smoke carbon movement around the globe.

4. Fire Ecology - This research contributes to improved conservation, restoration of burned areas, and appropriate ecological use of fire. Field and laboratory studies address these questions:

- How do fires and fuel consumption affect plants and plant communities?
- How do fires alter the flow of carbon and nutrients in ecosystems?
- How do fires affect the potential for weeds to establish or increase?



5. Fire and Fuel Management Strategies - We use case studies, modeling, and understanding of ecology to develop fire and fuel management strategies. These tools help managers and planners to increase the ability of forests to respond to disturbance and climate change and to reduce the unplanned losses of forest cover and stored carbon to fire, insects, and disease.

6. Science Synthesis and Delivery - Scientific publications form the foundation for science delivery. Synthesis of past research and integration of knowledge build on this foundation. From this science base the FFS Program provides:

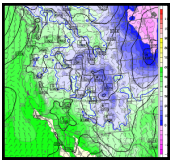
- computer programs and mentoring land managers
- classes, photo guides, field and lab tours, and training materials
- presentations for adults and children.



Research Facilities

The Fire, Fuel and Smoke Science Program has a wide variety of facilities and equipment located at the Fire Lab that enhance the Program research efforts.

The Lab is equipped with state-of-the-art burn chambers, comprehensive laboratory facilities, extensive computing resources, and novel field instrumentation which provide a unique environment to conduct innovative wildland fire research.



Advanced Computing Facilities: The Fire, Fuel and Smoke Science Program advances the state of the science related to modeling important processes which take place on the landscape. Advanced computing facilities provide the mission-critical capacity to expand the frontiers of modeling fire spread, fire danger, and air quality.

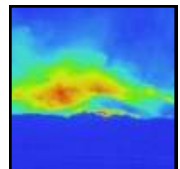
Lidar: In 2004, a mobile research-grade lidar instrument for smoke measurements was assembled and delivered to the Fire Sciences Lab (FSL), Missoula, MT from the University of Iowa.



Mobile Instrument Vehicle: Biomass burning releases considerable amounts of carbonaceous aerosols and greenhouse gases into the atmosphere, significantly impacting air quality. Field measurement of fresh smoke is important in determining key physical and optical properties and emission rates.



Thermal Imaging: Calibrated science-grade thermal infrared cameras turn the landscape into one big laboratory.



Satellite Downlink: The MODIS direct broadcast receiving station allows us to receive timely information about fire starts and fire progress.



Smoke Sampling: The Fire Atmospheric Sampling System (FASS) package samples smoke from the scene of a wild or prescribed fire and stores it in canisters for later analysis.

Sun Photometer: Automatic (commercial) and hand held (made in-house) sun photometers are used to study air quality by generating many *in situ* measurements against which satellite algorithms may be validated.



Gas Chromatography Lab: Smoke samples collected during experiments in the Fire Lab combustion chamber, from the FASS towers at wild or prescribed fires, or from aircraft traversing a smoke plume, are analyzed in the Gas Chromatography Lab,. Fire emissions (smoke) contain a complex mixture of gases.

Wind Tunnel and Combustion Lab: The wind tunnel/combustion facility at the Missoula Fire Sciences Laboratory is used to conduct burning experiments in a controlled environment under varying temperature, humidity, and wind condition.



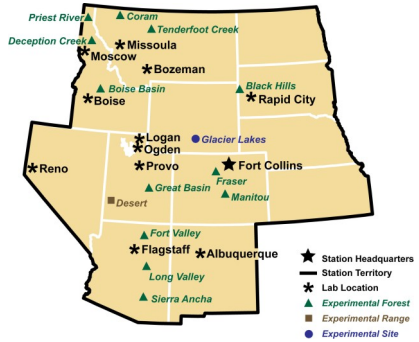
The Rocky Mountain Research Station



The **Rocky Mountain Research Station** is one of seven research 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 research locations across a 12-state territory encompassing the Great Basin, Southwest, Rocky Mountains and parts of the Great Plains. The Station employs over 400 permanent full-time employees, including roughly 100 research scientists.



Scientists conduct research that spans an area containing 52% of the nation's National Forest System lands (54 National Forests and Grasslands). In the lower 48 states, our territory also includes 55% of the nation's BLM lands; 48% of the designated wildernesses; 37% of National Park Service lands; numerous other public and tribal lands; and 41% of the non-urban/rural private lands.

The Missoula Fire Sciences Fire Lab is located on a campus which includes several Forest Service branches as well as other agencies. Our campus, the **Missoula Fire, Sciences, & Technology Center**, links missions dedicated to the pursuit of wildland fire research and technology development with those who apply the science, technology and fire safety.



And, the Missoula Fire, Sciences, & Technology Center Campus

The **Missoula Fire, Sciences, & Technology Center Campus** consists of the Missoula Fire Sciences Laboratory as well as:

- ◆ The **Northern Rockies Cache** is one of eleven National Interagency Support Caches set up across the United States to store, issue and refurbish supplies used primarily in the suppression of wild fires.
- ◆ The **National Weather Service (NWS)** in Missoula is responsible for warnings and forecasts covering 11 counties in western Montana and 3 counties in central Idaho. The NWS mission is to Protect Life and Properties through: timely warnings and accurate forecasts; serving public, aviation, agricultural, forestry and commercial weather needs; flood and river forecasts and warnings; weather and river observations and quality control of climate data.
- ◆ The **Missoula Technology and Development Center** provides practical solutions to problems identified by Forest Service employees and cooperators. The solutions help the Forest Service do its work more efficiently and more safely.
- ◆ The **Northern Rockies Training Center** mission is to provide and assure quality Wildland Fire Suppression, Incident Management, Aviation Management, Fire Use and Fuels Management training responsive to the needs and direction of the Northern Rockies Coordinating Group's member agencies.
- ◆ **Missoula Smokejumpers:** Since the beginning of the 1939 parachute project, the smokejumper mission offered a quick means to initial attack small lightning caused fires in extremely remote areas of the west.
- ◆ The **Northern Rockies Coordination Group** is established to provide an interagency approach to wildland fire management and all-risk support on all land ownerships within the States of Montana, North Dakota, northern Idaho, and a small portion of South Dakota and Wyoming.



Visit

<http://www.firelab.org>

To learn more about the Missoula Fire Sciences Laboratory

or

<http://www.fs.fed.us/rmrs>

To learn more about the Rocky Mountain Research Station

The United States Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal employment opportunity provider and employer.

