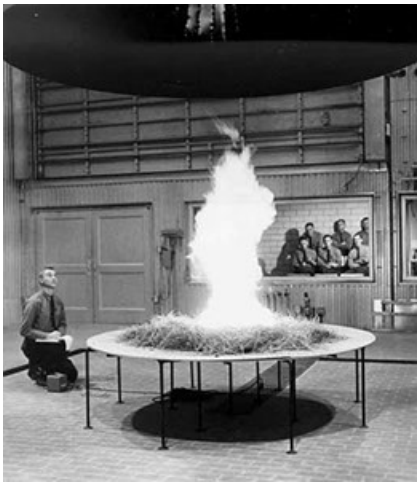
The Missoula Fire Sciences Laboratory:

A Celebration of 50 Years of Wildland Fire Research

1960 – 2010

September 18, 2010

Missoula, Montana



WILDLAND FIRE RESEARCH: A NEW BEGINNING

On September 12, 1960, Robert McArdle, Chief of the Forest Service, and Lee Metcalf, then U.S. Representative from Montana, dedicated what was then known as the Northern Forest Fire Laboratory ("Fire Lab") in Missoula. The Fire Lab's mission was straight forward:

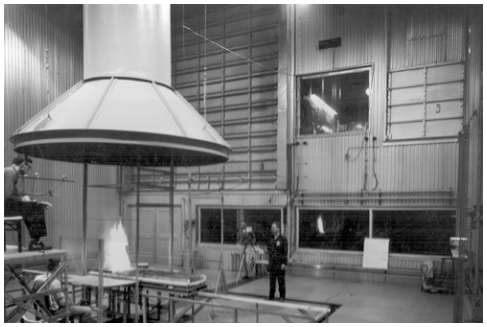
- to perform basic and applied research on critical wildland fire problems having nationwide application; and
- to conduct regional research on fire problems peculiar to the Intermountain West and Alaska.

The new facility allowed scientists and engineers to investigate the causes and behavior of wildfire in controlled environments, and included two state-of-the-science wind tunnels; a combustion laboratory to control air temperature, atmospheric pressure and relative humidity and compare the rate of fire spread under various conditions; a fuels laboratory to measure and analyze fire conditions based on the condition of the fuel itself (e.g. leaves, needles, grass, bark, tree limbs, twigs, etc.); a physics and chemistry laboratory; and a meteorology laboratory for tracking weather and wildfire conditions. A training room, another innovation for its time, provided a place where Forest Service personnel and others responsible for making decisions about wildfires could learn about Fire Lab research.

AN INTERDISCIPLINARY APPROACH

Since its earliest days, research conducted at the Missoula Fire Lab has been complex and innovative, involving hundreds of scientists, engineers, skilled technicians, and support personnel. Researchers have focused on everything from examining the fundamental physics of fire to investigating the effects of fire on ecosystems over time, and have explored questions at a variety of scales from chemical analysis of smoke pollution to interpretation of satellite images of the earth. Some researchers have looked to the past to understand the history of wildland fire and development of fire-dependent species, while others have collected data to analyze the effects of wildland fires and deforestation on global climate change and its potential impact on the planet. The following provides a brief overview of some of the Lab's early research and activities.

Fundamental Research



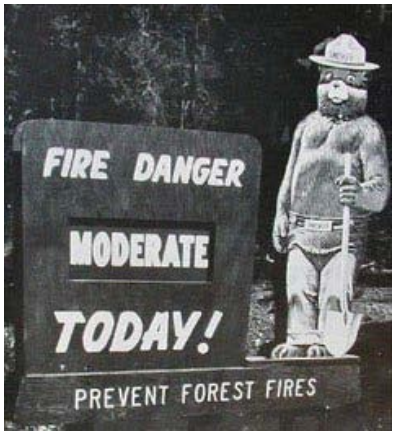
One of the Fire Lab's first studies, conducted by physicist Hal Anderson and engineer Richard Rothermel (both seated at left in the burn chamber above) measured the moisture content of wildfire fuels, such as grasses or twigs, and determined how these fuels burn when the moisture content drops below a certain level. Using the new facilities, their innovative research documented the effects of environmental conditions on approximately 200 fires burned under controlled humidity, air velocity, and fuel moisture. As the Chief of the Forest Service wrote in 1963, these findings had immediate application in the field, "red-flagging those occasional days when the moisture in [fine] forest fuels drops to 5 percent or below." This early

research also contributed to two follow-up breakthroughs for researchers at the Fire Lab: a model to predict wildland fire behavior and a national fire danger rating system.

Models and Systems

Hal Anderson and Richard Rothermel's initial research led them to consider if they could characterize wildland fires using a mathematical equation. As Rothermel later explained, managers in the field needed "a consistent method for predicting fire spread and intensity in these fuels." By 1972, working with Anderson and physicist Bill Fischer, Rothermel had done just that, publishing a model for predicting fire spread in wildland fuels, a groundbreaking contribution to understanding wildland fires. Other Fire Lab publications followed with mathematical models for fuel types, moisture levels, and other wildland fire components. Starting in 1976, mathematician Patricia Andrews (entering data above) began the process of integrating many of these models into a more cohesive system for use in the field. While designed for practitioners, her resulting BEHAVE system had to run remotely at the Lawrence Berkeley Lab until computers became more widely available in the early 1980s.

Fire Danger Rating



In addition to predicting how fast and hot wildfires will burn, managers need access to information on the risk of wildfire to inform the public of potential danger and to better prepare for fires should they occur. While fire danger is local, dependent on weather and other variables, Forest Service researchers had wanted to develop a national prediction system since the 1930s. In the mid-1960s, Fire Lab researchers were enlisted to assist in this effort, and have contributed ever since. For example, Richard Rothermel's fire spread model served as the basis for the first National Fire Danger Rating System, completed in 1972 by John Deeming and colleagues. Foresters Roberta Bartlette, Jim Brown, Robert Burgan, Jack Cohen, and other Fire Lab researchers have also contributed over the years. Today the national system uses satellite data relayed to managers via the Internet. Smokey Bear signs communicate to the public.

Field Studies

Not all Fire Lab research has been conducted within the state-of-the-art facilities. In 1966, for example, William Beaufait, Charles (Mike) Hardy, and William Fischer initiated a

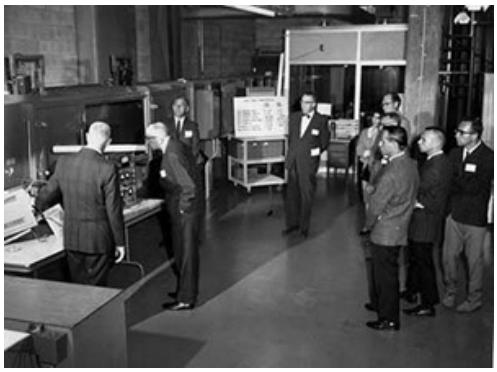
large-scale controlled research project in Montana on the effect of prescribed fire on air quality, vegetation and conifer regeneration, water quality, erosion, and small animal populations. Others, like ecologist Stephen Arno and his colleagues, have investigated wildland fire histories using fire scars on trees to better understand the role fire has played in shaping ecosystems and, later, by investigating tree rings, determining how weather affects wildlands and fire. In 1970, Fire Lab scientist Robert Mutch, working with another Forest Service forester, studied how fire could resume its natural role in the national forests, particularly those designated as wilderness. Their resulting plan for the White Cap Wilderness area was approved in 1972, allowing some wildland fires in the test area to burn without human interference. The success of their study led to a major shift in Forest Service policy in 1978, with some fires in national forests being allowed to burn rather than being put out immediately.

Fire Prevention and Control

Technology often drives the kinds of research that can be pursued. The availability of technology can also lead researchers to ask different kinds of questions about wildland fires. For example, at the end of World War II, many wanted to employ military hardware and expertise for peaceful civilian purposes. Jack Barrows (speaking above), who was instrumental in securing support and funding for the Fire Lab, encouraged the development of several innovative Fire Lab programs, from testing the use of bombers like the "Rocky Mountain Ranger" to extinguish fires, to applying new infrared technology to identify and map fires in remote or obscured locations (a technology still used to this day in some applications). Another innovation for its time was Project Skyfire, which developed techniques to "seed" clouds to prevent or minimize lightning strikes, a major cause of wildland fires in the Rocky Mountain

West. Unfortunately, as these early researchers discovered, altering weather on one side of the mountains can negatively affect those on the other side, so this project was eventually cancelled.

Education and Outreach



The dedicated training room in the new facility provided opportunities for fire managers, decision makers, and other scientists to learn about Fire Lab research. Researchers also routinely hosted national meetings and tours for international visitors and the general public alike. But researchers also took training programs on the road, teaching practitioners around the country how to use and interpret Fire Lab research and models, and adapted materials to make them more user friendly. For example, engineer Frank Albini developed a simple method to visually predict fire behavior in the field using a series of graphs or "nomograms." And before the introduction of personal computers, Robert Burgan programmed chips for Texas Instruments calculators to allow decision makers to use hand-held calculators to apply sophisticated models. All of these innovations helped ensure that Fire Lab research did not languish in the lab but was put to use as it became available.

THE RESEARCH CONTINUES

The availability of new technology allows today's researchers to pursue new questions not possible in 1960. For example, the Fire Lab now has the instrumentation and measurement tools to investigate how heat transfers from one particle to the next, and the role turbulence plays in that transfer. At the other extreme of scale, remote-sensing data from satellites help researchers monitor the effects of fire pollution, in essence expanding research from sampling instruments on the ground into studies that stretch over time and space. Researchers also can investigate the long-term air-quality effects of fires on global climate change and, through studies on the ground using tree rings and fire histories, anticipate the effects this might have on forest and other wildlands ecology and fires. As one researcher noted, "We're not going to run out of work anytime soon."

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