Pacific Wildland Fire Sciences Laboratory

IN BRIEF

The Pacific Wildland Fire Sciences Laboratory (PWFSL) is one of seven research facilities of the U.S. Forest Service's Pacific Northwest Research Station and one of only three Forest Service fire science laboratories in the Nation.

Fire research conducted at the Pacific Wildland Fire Sciences Laboratory examines the effects of weather and climate on fire, the effects of fire on ecosystems, and the impacts of smoke on human health.

The laboratory houses about 40 employees and research collaborators.

PACIFIC WILDLAND
FIRE SCIENCES LABORATORY

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FIRE RESEARCH AT THE LAB

Fire and Environmental Research

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- Improve understanding of hazardous fuels, wildfire effects, and prescribed fire.
- Provide decision support for fuel and fire hazard management.
- Understand the effects of climate on fire and other ecosystem disturbances.
- Understand and provide decision support for the effects of hazardous fuel treatments on forest ecosystems.

Atmosphere and Fire Interactions Research

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- Improve understanding of the role of weather and climate in fire and other ecological disturbances.
- Develop decision support tools for ecosystem management, fire operations, planning, and smoke management based on meteorology, air quality engineering, and climate dynamics.

EXPERTS

The Pacific Wildland Fire Sciences Laboratory is home to researchers who have expertise in wildland fire, fuel management, air quality, and smoke forecasting. For media assistance, contact Sherri Richardson Dodge, PNW Research Station's public affairs specialist, at (503) 808-2137 or srichardsondodge@fs.fed.us.

Climate and Climate Change

Sim Larkin, Don McKenzie, and David L. Peterson

Fuels

Morris C. Johnson, Roger D. Ottmar, David L. Peterson, and Clint Wright

Fire Ecology

Morris C. Johnson, Don McKenzie, David L. Peterson, and Clint Wright

Weather and Fire

Brian Potter and Miriam Rorig

Smoke and Emissions

Sim Larkin, Don McKenzie, Roger D. Ottmar, Brian Potter, Miriam Rorig, and Tara Strand

Resource Management

Roger D. Ottmar and David L. Peterson

Morris C. Johnson, an ecologist, studies fuel treatment effects on fire hazard in forest ecosystems in the Western United States. He is working to develop and test scientific principles for effective use of thinning and surface fuel treatments—such as prescribed burning, pile and burn, and mastication—to help remove fuels and to reduce the risk of crown fires.

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Sim Larkin, a research physical climatologist, studies air quality and climate. He led development of the BlueSky smoke modeling framework, which provides real-time predictions of smoke impacts from prescribed and wildland fires. BlueSky-based projections offer managers a tool to help predict and mitigate smoke issues before they affect the public.

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Don McKenzie, a research ecologist, studies fire and landscape ecology and the effects of climatic change on fire regimes. These include changes in regional air quality from smoke dispersion and the effects of increased fire severity and extent on sensitive species. He also studies the historical range of variability of fire regimes.

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EXPERTS

Roger D. Ottmar, a research forester, studies the interaction of fuels, fire, and smoke. He is currently refining the Fuel Characteristic Classification System (FCCS) for assessing fuelbeds and treatment effectiveness in North America, developing fuel consumption models to improve the management of smoke from wildland fire, and assessing wildland firefighter exposure to smoke for better management of individual health and safety.

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David L. Peterson, a research biologist, studies how fire disturbance can be integrated into the management of forest ecosystems in the Western United States. He is working to develop scientific principles for effective use of thinning and prescribed burning to help remove fuels and to reduce the risk of crown fires.

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Brian Potter, a research meteorologist, studies the effects of weather on fire behavior. His studies seek to improve fire behavior, fire danger, and smoke predictions through application of atmospheric physics. He also studies the history of fire weather science to identify potentially fruitful gaps in current research.

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Miriam Rorig, a research meteorologist, focuses her work in the area of fire weather meteorology. This work includes better understanding the risk of dry lightning outbreaks, using meteorological models to predict fire weather danger indices and fuel moisture, and modeling smoke transport and dispersion.

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Tara Strand, an air quality engineer, studies air quality and smoke emissions, in part by using the BlueSky smoke modeling framework. Her research also examines pheromone transport in forests and its effects on insects.

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Clint Wright, a research forester, studies fuel dynamics, fire effects, and fire ecology. He is developing tools for characterizing fuels and models for predicting fuel consumption to help managers determine the impacts of prescribed and wildland fire on ecosystem properties and air quality.

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RECOMMENDED READING

To access a Web database of Forest Service Research & Development publications online that contains over 28,000 full-text articles and reports, visit http://www.treesearch.fs.fed.us. A ✪ icon below denotes a publication written for general audiences.

Fuels

✪ McIver, J.; Ottmar, R.D. 2002. **Postfire logging: Is it beneficial to a forest?** Science Findings 47. http://www.fs.fed.us/pnw/sciencef/scifi47.pdf

Ottmar, R.D.; Sandberg, D.V.; Riccardi, C.L.; Prichard, S.J. 2007. **An overview of the Fuel Characteristic Classification System—quantifying, classifying, and creating fuelbeds for resource planning**. Canadian Journal of Forest Research. 37(12): 2383-2393. http://www.treesearch.fs.fed.us/pubs/29460

Big Fire

Keeley, J.E.; Aplet, G.H.; Christensen, N.L. [and others]. 2009. **Ecological foundations for fire management in North American forest and shrubland ecosystems**. Gen. Tech. Rep. PNW-GTR-779. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 92 p. http://www.fs.fed.us/pnw/pubs/pnw_gtr779.pdf

Kellogg, L-K.B.; McKenzie, D.; Peterson, D.L.; Hessl, A.E. 2008. **Spatial models for inferring topographic controls on historical low-severity fire in the eastern Cascade Range of Washington, USA**. Landscape Ecology. 23: 227-240. http://www.treesearch.fs.fed.us/pubs/30439

✪ Mazza, R. 2007. **Managing forests after fires**. Science Update 15. http://www.fs.fed.us/pnw/pubs/science-update-15.pdf

Peterson, D.L.; Agee, J.K.; Aplet, G.H. [and others]. 2009. **Effects of timber harvest following wildfire in western North America**. Gen. Tech. Rep. PNW-GTR-776. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 51 p. http://www.fs.fed.us/pnw/pubs/pnw_gtr776.pdf

Fuel Treatment

Johnson, M.C.; Peterson, D.L.; Raymond, C.L. 2007. **Guide to fuel treatments in dry forests of the Western United States: assessing forest structure and fire hazard**. Gen. Tech. Rep. PNW-GTR-686. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 322 p. http://www.treesearch.fs.fed.us/pubs/27293

Johnson, M.C.; Peterson, D.L.; Raymond, C.L. 2007. **Managing forest structure and fire hazard—a tool for planners**. Journal of Forestry. 105(2): 77-83. http://www.treesearch.fs.fed.us/pubs/29739

✪ Peterson, D.L.; Johnson, M.C. 2007. **Science-based strategic planning for hazardous fuel treatment**. Fire Management Today. 67(3): 13-19. http://www.treesearch.fs.fed.us/pubs/29336

Peterson, D.L.; Johnson, M.C.; Agee, J.K. [and others]. 2005. **Forest structure and fire hazard in dry forests of the Western United States**. Gen. Tech. Rep. PNW-GTR-628. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 30 p. http://www.fs.fed.us/pnw/pubs/pnw_gtr628.pdf

RECOMMENDED READING

Raymond, C.L.; Peterson, D.L. 2005. **Fuel treatments alter the effects of wildfire in a mixed-evergreen forest, Oregon, USA.** Canadian Journal of Forest Research. 35: 2981-2995. http://www.treesearch.fs.fed.us/pubs/24571

Youngblood, A.; Wright, C.S.; Ottmar, R.D.; McIver, J.D. 2008. **Changes in fuelbed characteristics and resulting fire potentials after fuel reduction treatments in dry forests in the Blue Mountains, northeastern Oregon**. Forest Ecology and Management. 255: 3151-3169. http://www.treesearch.fs.fed.us/pubs/33123

Smoke

McKenzie, D.; O'Neill, S.M.; Larkin, N.K.; Norheim, R.A. 2006. **Integrating models to predict regional haze from wildland fire**. Ecological Modelling. 199: 278-288. http://www.treesearch.fs.fed.us/pubs/29729

✪ Potter, B.; Larkin, N.K.; Nikolov, N. 2006. **Smoke, fire, and weather: what Forest Service research is doing to help**. Fire Management Today. 66(3): 12-16. http://www.fs.fed.us/fire/fmt/fmt_pdfs/FMT66-3.pdf

✪ Rapp, V. 2006. **A clear picture of smoke: BlueSky smoke forecasting**. Science Update 14. http://www.fs.fed.us/pnw/pubs/science-update-14.pdf

Sandberg, D.V.; Ottmar, R.D.; Peterson, J.L.; Core, J. 2002. **Wildland fire in ecosystems: effects of fire on air**. Gen. Tech. Rep. RMRS-GTR-42-vol. 5. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 79 p. http://www.fs.fed.us/rm/pubs/rmrs_gtr042_5.pdf

Fire Weather

Clements, C.D.; Zhong, S.; Goodrick, S. [and others]. 2007. **Observing the dynamics of wildland grass fires: FireFlux—a field validation experiment**. Bulletin of the American Meteorological Society. 88(9): 1369-1382. http://treesearch.fs.fed.us/pubs/33353

✪ Potter, B.E. 1997. **Making sense of fire weather**. Fire Management Notes. 57(2): 26-27. http://www.fs.fed.us/fire/fmt/fmt_pdfs/fmn57-2.pdf

Potter, B.E.; Borsum, D.; Haines, D. 2002. **Keeping Haines real—Or really changing Haines?** Fire Management Today. 62(3): 41-46. http://www.fs.fed.us/fire/fmt/fmt_pdfs/fmt62-3.pdf

Potter, B.E.; Charney, J.J.; Heilman, W.E.; Bian, X. 2007. **Advances in fire convection dynamics**. In: Furniss, M.; Clifton, C.; Ronnenberg, K., eds. Advancing the fundamental sciences: proceedings of the Forest Service national earth sciences conference. Gen. Tech. Rep. PNW-GTR-689. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 59-65. http://www.treesearch.fs.fed.us/pubs/29375

Potter, B.E.; Winkler, J.A.; Wilhelm, D.F.; Shadbolt, R.P. 2007. **Computing the low elevation Haines Index**. Fire Management Today. 67(1): 40-43. http://www.fs.fed.us/fire/fmt/fmt_pdfs/FMT67-1.pdf

Winkler, J.A.; Potter, B.E.; Wilhelm, D.F. [and others]. 2007. **Climatological and statistical characteristics of the Haines Index for North America**. International Journal of Wildland Fire. 16(2): 139-152. http://treesearch.fs.fed.us/pubs/33354

KEY SOFTWARE AND TOOLS

Researchers at the Pacific Wildland Fire Sciences Laboratory actively work with land managers, resource practitioners, and others to ensure their findings are put to use. A summary of key fire and smoke software programs and tools is below. For a complete listing, visit http://www.fs.fed.us/pnw/publications/firetools.shtml.

BlueSky

BlueSky is a modeling framework that links numerous independent models of fire information, fuel loading, fire consumption, fire emissions, and smoke dispersion to simulate the cumulative impacts of smoke on air quality. The framework has the ability to calculate, among other things, the likely dispersal pathway of smoke given off by a fire and concentrations of smoke. To learn more, visit http://www.airfire.org/bluesky.

CONSUME

CONSUME is a software application that calculates fuel consumption and emission data based on fuel conditions, burning pattern, and meteorological attributes. CONSUME can be used for wildfires and prescribed fires in most forests, shrublands, and grasslands in North America. To learn more, visit http://www.fs.fed.us/pnw/fera/research/smoke/consume/index.shtml.

Fuel Characteristic Classification System

The Fuel Characteristic Classification System (FCCS) is a comprehensive software system that builds, characterizes, and classifies fuelbeds across the United States. It accurately captures the structural complexity and geographic diversity of fuel components across landscapes, provides the ability to assess elements of human and natural change, and calculates fire behavior and fire effects. FCCS output is used in fire emission inventories and in fuel and carbon assessments across large landscapes. To learn more, visit http://www.fs.fed.us/pnw/fera/fccs.

Guide to Fuel Treatments in Dry Forests of the Western United States

Guide to Fuel Treatments in Dry Forests of the Western United States is a publication that analyzes a range of fuel treatments for representative dry forest stands in the West. Resource managers can use the guide to anticipate the effects of fuel treatment scenarios on surface fuels, fire hazard, potential fire behavior, and forest structure. The publication is available for download from http://www.treesearch.fs.fed.us/pubs/27293.

Natural Fuels Photo Series

The Natural Fuels Photo Series is designed to help land managers appraise fuel and vegetation conditions in natural settings. Fire and fuel managers can use the photo series to plan and implement fuel treatments to better achieve desired effects while minimizing negative impacts on other resources. To learn more, visit http://www.fs.fed.us/pnw/fera/research/fuels/photo_series.