

TITLE: Post-mountain pine beetle lodgepole pine forests: Assessing fire behavior and fire effects in the recently burned Pole Creek Fire area on the Sisters Ranger District, Deschutes National Forest.

LOCATION: Deschutes National Forest, Central OR.

DATE: 9-30-12

DURATION: 2013-2014

FUNDING SOURCE: Fire Plan EM

PROJECT LEADER: Stephen Fitzgerald, Silviculture and Fire Ecology Extension Agent - Department of Forest Engineering, Resources, and Management, Oregon State University, 541-737-2845, stephen.fitzgerald@oregonstate.edu

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PROJECT OBJECTIVES: This study will use *in situ* fire behavior and weather observations, pre-fire fuels and forest structure data, and post-fire monitoring in the Pole Creek Fire (2012) to characterize fire behavior and fire effects (e.g., severity, fuel consumption, tree mortality) within stands previously affected by mountain pine beetle.

JUSTIFICATION: Aerial detection surveys have noted high levels of mountain pine beetle (MPB) mortality in lodgepole pine in the study area. Fuel loadings in these areas have prompted questions from managers regarding potential fire behavior and post-fire effects. Recent work by the Project leader and other scientists (*see* Hicke et al. 2012) has begun to elucidate relationships of fuels over time since MPB disturbance. Using previously collected plot data and results from fire behavior analyses, direct observations of fire behavior and weather, as well as post-fire monitoring of fire effects; this project serves to provide managers important validation of fire behavior and fire effects in post-MPB lodgepole pine forests.

a. Linkage to FHM Program: Analysis of FHP Detection Monitoring Aerial Detection Survey (ADS) data shows large lodgepole pine mortality events from MPB from 1998-2005 in the study area. These areas have also been identified by local forest and fire managers as direct wildfire threats to the Wildland Urban Interface (WUI). Through previous funding, the Project leader and cooperators have installed and measured fuels and forest structure plots (based on ADS data) within the boundary of the Pole Creek Fire, which occurred in September 2012. Using this plot level information and data from additional plots outside the fire perimeter, we have gained valuable information on pre-fire fuels and are currently involved in modeling potential fire behavior in post-MPB epidemic areas using these fuels estimates.

b. Significance/Impact: Restoration of healthy, diverse, and resilient ecosystems and reducing hazardous fuels to protect communities at risk, municipal watersheds at risk for wildfire, and threatened and endangered species habitat, are the main objectives of the National Fire Plan. The proposed project will assist in meeting these objectives by evaluating fuel consumption, fire behavior, and ecological impacts (i.e., severity, fuel consumption, soil effects, and vegetation recovery) of fire in MPB influenced areas to identify where conditions favor uncharacteristically intense fires. Products derived from this project will be applicable across both the Deschutes and Fremont-Winema National forests where concerns exist over potentially extreme fire behavior in high lodgepole pine mortality as a result of MPB epidemics and subsequent fuel accumulation.

d. Scientific Basis: The effect of changes in fuels from MPB epidemics on fire behavior is unclear (Hicke et al. 2012). Much of this work has been focused on red stage lodgepole pine while the needles are still attached (Simard et al., 2011) and most results are based on simulation modeling (Hicke et al. 2012; Simard et al 2011; Page and Jenkins 2007) rather than direct observation or post-fire monitoring. With the availability of pre-fire fuels data, *in situ* fire behavior and weather observations, and post-fire effects monitoring, this project will provide much needed validation of previous findings.

e. Cost/Economic Efficiency: The cost efficiency of this project is high given: **1)** Previously funded field data collection and fire behavior analyses (Joint Fire Science - JFSP) for comparisons with data already collected during fire observation and FEMO (Fire Effects Monitor) work and with data from this project. Further funding from JFSP is not available as current call for proposals does not have a re-measurement task **2)** Current and ongoing cooperative relationships with FHP and local forest managers, and contributed time from cooperators with the Central Oregon Fire Management Service, **3)** Contributed overhead (20%) by OSU as cost-share. Remaining overhead required by OSU for FY2013/2014 is equal to 26%. **4)** Contributed time of Project leader (5%) and RMRS Fire Modeling Institute Cooperator as cost share, contribution of equipment for data collection, supply costs for field work and computer support are also contributed. In addition, we have requested funding through an OSU initiative to mentor an undergraduate student to participate in information gathering on fire behavior. If granted this will supply an additional \$3,500 to the overall project. Project costs are: **FY2013** - Salary for Research Assistant and field technicians for collection of information, project coordination, sampling design, and data collection. Travel and supply costs are for field data collection. **FY2014** – Salary costs are for Research Assistant to perform data QA/QC, analysis, report/manuscript writing, and outreach activities. Travel costs are for outreach activities and travel to conference to report findings.

f. Priority Issues: This project will address the following components under the National Fire Plan: 1) fire risk and fuel loading; and 2) rehabilitation and restoration of fire-damaged ecosystems through a better understanding of ecological impacts of fire in lodgepole pine. This information will better inform manager decision making as it directly relates to two areas of concern: post-MPB epidemic fuels and forest structure and proximity of these fuels to the wildland-urban interface (WUI) boundary. Information gleaned from observations by Pole Creek fire managers will also assist with issues of firefighter safety in post-MPB affected forests.

DESCRIPTION:

a. Background: Mountain pine beetle has recently caused heavy mortality to lodgepole pine on

the Deschutes National Forest (DNF), and throughout the west. Over 400,000 acres of MPB caused mortality were reported on federal lands in Oregon in 2010 (Forest Health Highlights in Oregon – 2010). The effect on fuels, especially in areas adjacent to the WUI, is of great concern. Our cooperative group (FHP, OSU, RMRS-FMI) has been working on a Joint Fire Science project investigating the temporal dynamics of fuels and their potential effects on fire behavior, following MPB epidemics in the lodgepole pine zone of south-central Oregon using a chronosequence approach. We have installed over 200 plots across the Fremont-Winema and DNF. This data is providing insights into changes in fuels over time following these epidemics (e.g., transitions of red dying canopies, timing of increases in fine surface fuels) and we're currently completing fire behavior modeling efforts. Recently (September 2012), the Pole Creek Wildfire burned through a subset of these plots on the DNF. A great deal of information regarding weather (including portable Remote Automated Weather stations) and fire behavior (direct observations, photos, video), pre-fire fuels data (collected by assigned FEMOs), and management actions (e.g., burnout operations) were gathered during this fire by COFMS collaborators. Using previously collected data and results from current analyses, combined with FEMO monitoring information and post-fire monitoring of fire effects (re-measurement of existing plots and installation of additional monitoring plots), provides a unique opportunity to link changes in fuels following MPB epidemics with observed fire behavior and effects.

b. Methods: Initial work will involve gathering and assessing weather and fire behavior observations collected by fire managers and FEMO during the Pole Creek Fire. Additional information on fire operations (e.g., burnout operations) will be gathered and assessed, as this information is crucial in elucidating natural and human induced fire behavior and effects. Working with data collected during the fire, FHP ADS data, post-fire severity maps, and with input from local fire and fuels managers, plots will be selected and located in stands based on MPB extent and severity (trees per acre mortality) within the Pole Creek Fire. Additional plots will be placed in different forest types (e.g., mountain hemlock, ponderosa pine, mixed conifer) to compare fire behavior and effects with MPB influenced climax lodgepole pine, as well as lodgepole pine types outside of the fire. If previous forest health issues are present and confirmed via aerial detection survey, these will be incorporated into the monitoring design. In addition, re-measurement of existing fuels plots will provide the ability to compare post-fire to pre-fire data to determine fuel consumption and carbon emissions and the relationship between pre-fire fuels and fire effects. Comparisons of pre-fire behavior modeling results (*BehavePlus*), with *in situ* observations and post-fire fuel consumption and fire effects data, will provide much needed insight into the relationships between post-MPB disturbance fuels, fire behavior, and fire effects.

c. Products: **1)** Gathering, organization, summarization, and assessment of weather, fire behavior, and fire management information collected during the Pole Creek Fire. **2)** Post-fire fuel consumption and fire effects data in both MPB impacted lodgepole pine and other forest types within the fire for comparison. **3)** Evaluation of previous modeling results of fire behavior in MPB influenced areas. **4)** Reports and outreach (e.g., field tours, workshops) to fuels and fire managers. **5)** Peer reviewed manuscript.

d. Schedule of Activities: FY 2013: Coordination with fire managers on DNF to gather information relevant to the Pole Creek fire, including weather observations, fire behavior observations (photos, video, written, and oral accounts), and fire management tactics (e.g., burnout operations). Using ADS data, fire severity maps, forest type and ancillary ecological

information, additional plots will be randomly selected for measurement of fire behavior and effects. These plots will then be installed and measured. **FY 2014:** Data QA/QC processing, data analysis, report/manuscript preparation, and outreach activities.

e. Progress/Accomplishments:

A spatially balanced random sampling design was used to select plots across varying levels of burn severity (unburned/low/moderate/high) and mountain pine beetle mortality (low/moderate/high). This was accomplished using burn severity maps produced from LandSat dNBR spatial data and Aerial Detection Survey data. A protocol was developed to examine the degree of mountain pine beetle mortality and its influence on burn severity. All re-measurement plots have been completed and the majority of randomly sampled plots have been measured. The remaining plots are currently being measured and should be completed in the next several weeks.

Coordination with collaborators from the Western Wildland Environmental Threat Assessment Center and the University of Idaho were formed to further understand fire severity using LandSat derived dNBR burn severity maps as well as to collaborate on LiDAR research occurring on the fire.

In addition, the undergraduate student project looking at fire behavior observations and fire management tactics was completed. This project has provided us with information regarding fire behavior and weather data, as well as better insight into management decisions and suppression actions during the fire. This information has been converted into spatial data where applicable.

f. Relevant Citations:

Woolley, T., Shaw, D., Fitzgerald, S., Kurth, L. (2011). Mountain Pine Beetle (*Dendroctonus ponderosae*) and Lodgepole pine (*Pinus contorta*) in south-central Oregon: Fuel dynamics and consequences for fire behavior through time. Proceedings of 3rd Fire Behavior and Fuels Conference, October 25-29, 2010, Spokane, Washington, IAWF.

Hicke J.A., Johnson, M.C., Hayes, J.L., Preisler, H.K. (2012) Effects of bark beetle-caused tree mortality on fire. *Forest Ecology and Management*. 271:81-90

Simard, M., Romme, W.H., Griffin, J.M., Turner, M.G., (2011) Do mountain pine beetle outbreaks change the probability of active crown fire in lodgepole pine forests? *Ecological Monographs* 81:3–24.

Page, W., Jenkins, M.J., (2007) Predicted fire behavior in selected mountain pine beetle-infested lodgepole pine. *Forest Science* 53:662–674.

	Item	Requested FHM EM Funding	Other Source Funding	Source
Year 1 :2013				
Administration	Salary	\$27,505	\$7,779	OSU
			\$2,700	RMRS FMI
			\$3,000**	OSU student grant
	Overhead	\$9,870	\$7,592*	OSU contributed overhead

	Travel	\$9,455	\$500**	Student Travel
Procurements	Contracting	\$0		
	Equipment	\$0		
	Supplies	\$1,000	\$1,000	OSU
Total, Year 1		\$47,830	\$19,071	
Year 2: 2014				
Administration	Salary	\$43,312	\$7,779	OSU
			\$2,700	RMRS FMI
	Overhead	\$11,781	\$9,062*	OSU contributed overhead
	Travel	\$2,000		
Procurements	Contracting	\$0		
	Equipment	\$0		
	Supplies	\$0	\$1,554	
Total, Year 2		\$57,093	\$21,095	

*Oregon State University contribution of unrecovered overhead (20%).

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