

TITLE: Modeling Fire Spread and Intensity across Bark Beetle-Affected Landscapes

LOCATION: Intermountain Region National Forests

DURATION: 2007-2009

FUNDING SOURCE: Fire Plan

PROJECT LEADER: Michael Jenkins, Department of Forest, Range and Wildlife Sciences, Utah State University, Logan, Utah 84322-5230

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PROJECT OBJECTIVES:

We have developed custom fuel models for bark beetle-affected fuels in coniferous forests of the Intermountain Region. The objectives of this project are to use our custom fuel models and the landscape scale fire behavior models FARSITE and FlamMap to simulate fire spread across bark beetle-affected landscapes identified using Forest Health Monitoring Detection Monitoring Tools and data from the LANDFIRE project (Landscape Fire and Resource Management Planning Tools Project).

JUSTIFICATION:

Recent FHM survey and plot data of Intermountain forests suggest that 48% of stands throughout the Intermountain Region have a structure and composition conducive to bark beetle outbreak (O'Brien 1999). The relationships between fire and western bark beetles in forests of North America have not been extensively studied (Baker and Veblen 1990, Bebi et al. 2003, Brown 1975, Kulakowski et al. 2003, Lotan et al. 1986, Veblen et al. 1994). No studies have attempted to quantify the changes in forest fuel complexes caused by the bark beetle induced tree mortality. In previous studies supported by the, Special Technology Development Program, Forest Health Monitoring and the Joint Fire Science Program we quantified changes in forest fuel complexes caused by bark beetle-induced tree mortality and developed custom fuel models to make more accurate estimates of fire behavior (Page and Jenkins, in review).

Two-dimensional fire growth models in bark beetle-affected landscapes are lacking. The work proposed here will use our custom fuel models, aerial detection survey maps, and data from the LANDFIRE project to create FARSITE/FlamMap fire growth and intensity simulations. These simulations will provide fire planners, forest health specialists, forest health monitoring personnel and other land managers with the tools necessary to evaluate the ecological impacts of bark beetle activity based on fire risk, intensity and spread.

With the predicted continuation of widespread drought in the West bark beetle outbreaks will intensify across large acreages of susceptible stands. Techniques to predict the consequences of bark beetle altered fuels on fire hazard at the landscape scale are vital to fire planners and land managers.

DESCRIPTION:

a. Background:

We have quantified the effects of bark beetles on fuel characteristics of infested stands through time. We measured the forest biomass of stands with endemic, epidemic, and post outbreak populations of bark beetles in Engelmann spruce (*Picea engelmannii* Parry ex Engelm), Douglas-fir (*Pseudotsuga menziesii* Mirb. Franco), and lodgepole pine (*Pinus contorta* Engelm.) forest cover types. We compared the quantity and quality of fuels present within each population phase and use the measured fuel characteristics to construct custom fuel models using the methods developed by Burgan and Rothermel (1984). Fuel models are stylized and simplified descriptions of the fuel complex for input into fire hazard and behavior prediction models. They represent a set of equations or numbers that describe the fuel for the fire model. This work produced fuel models that are customized to the actual set of fuel conditions created by the activity of bark beetles over the course of epidemics. With these custom fuel models and average worst case fire weather estimates we 1) assessed changes in fire danger rating (i.e. likelihood of ignition and spread) and 2) predicted potential fire behavior (rate of spread, flame length and intensity) using the fire spread model, BEHAVEplus (Rothermel 1983).

This work will use supporting data from the LANDFIRE project and the fire behavior modeling programs FARSITE and FlamMap to incorporate our custom fuel models to simulate the spread and intensity of wildfires across bark beetle-affected landscapes.

b. Methods:

Forest Health Monitoring plot data and aerial detection survey maps will be used to locate stands with various levels of bark beetle activity from endemic to post epidemic. Within these identified areas the basic landscape data necessary to run the FARSITE and FlamMap programs will be gathered from the LANDFIRE project. We will then modify the existing fuel and vegetation characteristics in this data to incorporate our custom fuel models as well as other site specific data obtained through extensive field sampling. The modified data will then be used with the programs FARSITE and FlamMap to model fire spread and intensity across the selected bark beetle-affected landscapes.

c. Products: 1) Animated FARSITE/FlamMap simulations based on aerial detection maps of bark beetle mortality and specific fuel descriptions. 2) poster/presentation

d. Schedule of Activities: 2007: locate suitable aerial detection maps and validate map information using ground surveillance and forest health monitoring plot data, 2008: develop FARSITE simulations product development, dissemination and training.

| COSTS: | Item | FHM EM Funding | Other Source Funding | Source |
|----------------------------|-------------|-----------------------|-----------------------------|---------------------------|
| 2007 Administration | Salary | \$24,000. | \$15,000. | USU, R4 FHP, Mendocino NF |
| | Overhead | 3,600. | 2,595. | |
| | Travel | 3,500. | | |
| Procurements | Equipment | 500. | | |
| | Supplies | 500. | 1,000. | |
| 2007 Totals | | \$32,100. | \$18,595. | |
| 2008 Administration | Salary | \$24,000. | \$15,000. | USU, R4 FHP, Mendocino NF |
| | Overhead | 3,600. | 2,595. | |
| | Travel | 3,500. | | |
| Procurements | Equipment | 500. | | |
| | Supplies | 2,000. | 1,000. | |
| 2008 Totals | | \$31,600. | \$18,595. | |

BUDGET REQUEST EXPLANATION: Salary costs are for two months salary for PI plus benefits (43.25%) graduate student salary and technician support. Travel is for 2 people at \$25.00/day and \$1000.00/month for vehicle rental. Other source funding includes salary for PI and USFS cooperators. Equipment and supplies are miscellaneous field materials.

References upon request