Assessing post-fire tree survival in Oregon and Washington

R. A. Progar[1], L.Ganio[2], D. Scott[3], C. Schmitt[3], L. Spiegel[3], B. Hostetler[4], B. Wilhite[4], A. Eglitis[5], K. Chadwick[3], C. Mehmel[6], D. Goheen[7], S. Acker[8], A. Blum[2]

[1]PNW Research Station, La Grande, OR; [2]College of Forestry, Oregon State University, Corvallis, OR [3]Forest Health Protection (FHP), La Grande, OR; [4]FHP, Sandy, OR; [5]FHP, Bend, OR; [6]FHP, Wenatchee, WA; 7[6]FHP, Central Point, OR; [8]National Park Service, Olympic National Park, WA;

Introduction

This project was initiated to refine/calibrate/develop guidelines to assess the survival of trees after fire (wildfire or prescribed burn) in Oregon and Washington. There are many models and methods of evaluating the survival of trees following injury by fire in the western US. Few have been developed to evaluate tree survival in the Pacific Northwest. Even fewer of the methods used by forest managers have been evaluated for accuracy.

The unknown ability of these models or rating systems to accurately predict tree survival across a range of habitat and soil types, conifer species, fire conditions, and various other factors has created the need for validation and calibration of existing models. The objectives of this project are to (1) assess mortality of trees in R6 caused by direct fire injury, and secondary mortality caused by insects attacking injured trees, and the causal impacts of factors such as time, spatial correlation, precipitation, elevation, and species; and (2) to assess the application of existing survival models in Oregon and Washington.

Methods

We established transects in 25 fires across Oregon and Washington (see map). Fire severity data consistent with most of the published tree survival models was collected for 3-5 years after fire. We also surveyed for bark beetle and wood borer activity and disease presence. Each tree is evaluated annually for condition (live/dead) and insect activity.

Preliminary Analyses

We used the area under the Receiver Operating Characteristic curve (AUC) as a measure of the overall discriminatory ability of a post-fire logistic regression model to predict tree mortality 3 years post fire.

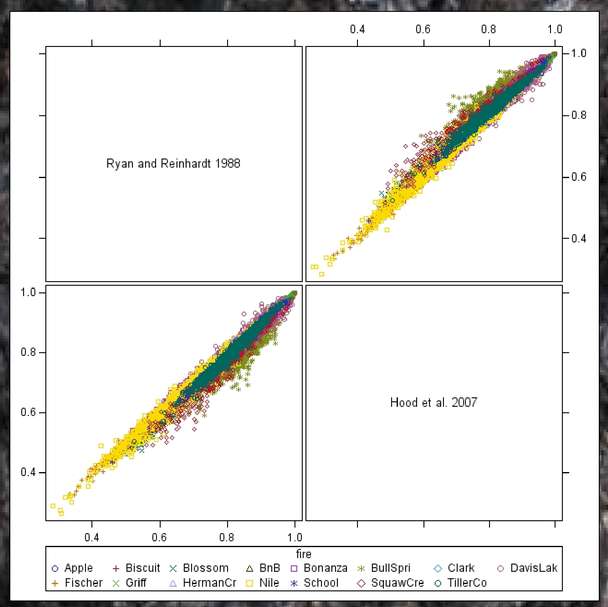
Values of AUC closer to 1.0 indicate that a model is better able to predict dead trees as dead and live trees as alive.

We applied each of 6 post fire logistic regression models for *Pinus ponderosa* to 1000 bootstrap samples from 9 fires and we applied 2 post-fire logistic regression models models for *Pseudotsuga menzisii* to 1000 bootstrap samples from 14 fires across Oregon and Washington.

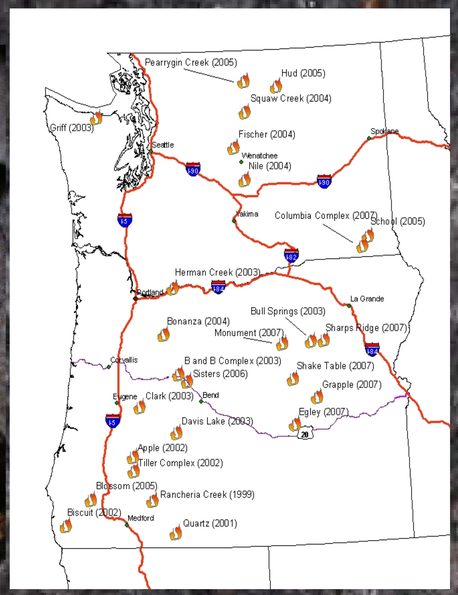
Cambium condition was sampled from each quadrant.

In this preliminary analysis, we used fires in which more than 50 trees of a species were sampled and where we could be reasonably certain that the mortality did not significantly increase after 3 years.

AUC statistics for 2 Douglas-fir Post-fire Mortality Prediction models applied to trees injured by fire in Oregon and Washington. The two models below behave similarly among fires.

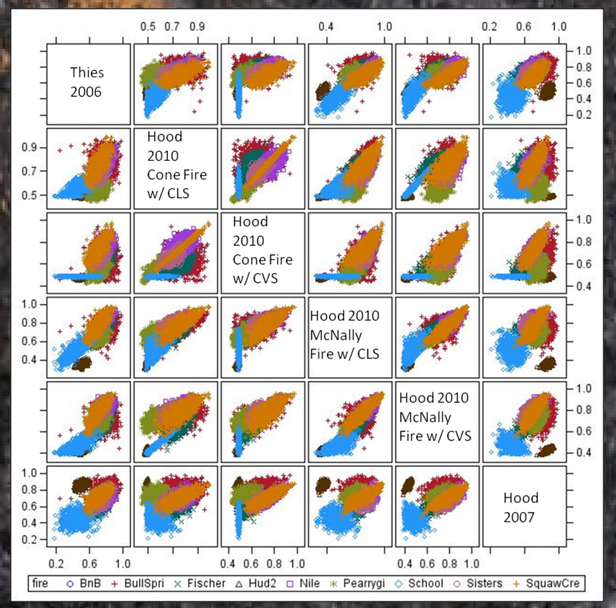


Colors are associated with different fires



Study trees are located in wild and prescribed fires throughout Oregon and Washington.

AUC statistics for 6 Ponderosa pine Post-fire Mortality Prediction models applied trees injured by fire in Oregon and Washington



Colors are associated with different fires .

Horizontal and vertical axes are AUC values for 1000 bootstrap samples from 9 Oregon wildfires. If models predicted tree death similarly values Would fall on the 1:1 line. Models with strong Overall discriminatory ability will have AUC values close to 1.0.

Preliminary Results & Discussion

The above graphic illustrates:

1. Models differ in their discriminatory ability

2. A model's discriminatory ability varies among fires .

This project has generated the most comprehensive data set to date for assessing tree survival after fire injury. After five years, data on more than 13,000 trees have been measured and are monitored annually from 25 wild and prescribed fires in Oregon and Washington.

Following the 2010 field season and data collection we will develop a model of tree survival following fire injury by tree species that encompasses spatial, temporal, and elevation variables in addition to first and second order fire effects inherent to forest/fire conditions in Oregon and Washington.

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