Assessing post-fire tree survival in Oregon and Washington

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

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

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 exist 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.

Red turpentine beetle (*D. valens*) is a significant indicator of stress in California.

Methods

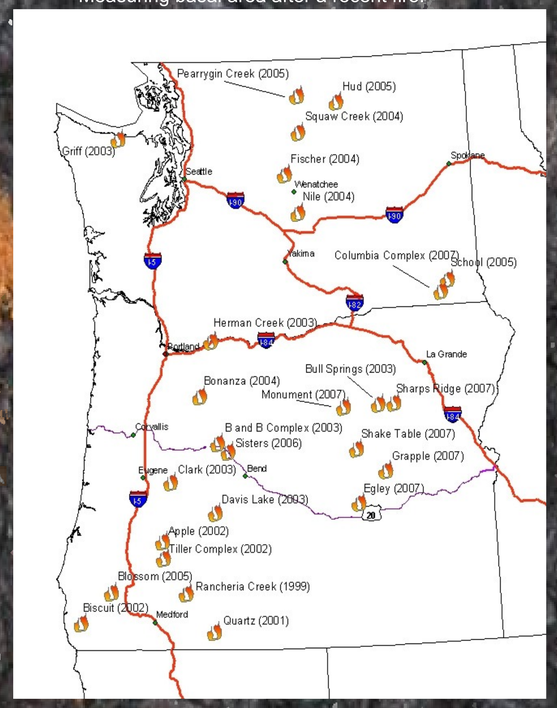
We established transects in 25 fires across Oregon and Washington (see map). We took standard tree measurements such as tree height and dbh and measured parameters related to fire injury. Trees were also surveyed for bark beetle attack and disease presence. Individual trees are monitored for 5 years to assess delayed mortality and/or insect attack.

Drilling to determine a tree's cambium condition.

Measuring basal area after a recent fire.

Some of the variables measured for model development and validation.

- Season of fire
- Elevation
- DBH
- Tree height
- Pre & post-fire live crown height
- Bole scorch height
- Crown scorch volume/proportion
- Bark char rating
- Ground char/ duff consumption
- Cambium mortality
- Dwarf mistletoe rating
- Insect attack



Study fires are located throughout Oregon and Washington.

Measuring tree and crown height.

Species	# sampled	Avg. DBH (in.)	DBH range	Avg. bole scorch ht. (ft.)	Range bole scorch ht.	Avg. crown vol. scorch (%)	Range crown vol. scorch (%)	Avg. tree height (ft.)	Range tree height (ft.)
Ponderosa pine	5225	19.1	5-49.2	13.8	0-90	29.8	0-100	79.2	15-198
Douglas-fir	4024	22.7	4-83	16.9	0-120	23.4	0-100	102.0	20-284
White fir	940	20.0	5-86	11.8	0-108	33.8	0-100	81.0	18-165
Grand fir	778	18.8	6-43	10.4	0-80	29.5	0-100	83.1	18-178
Western hemlock	579	18.8	5-52	7.3	0-86	29.2	0-99	96.9	25-173
Western larch	472	14.8	5.5-47	13.6	0-107	19.2	0-100	89.5	40-169
Sugar pine	215	29.2	6-70.7	22.2	0.5-104	32.3	0-100	105.2	20-204
Engelmann spruce	216	18.4	5.3-37	7.8	0-74	21.3	0-100	87.0	24-140
Lodgepole pine	131	11.6	5.3-22.3	6.6	0-70	15.8	0-95	66.9	35-118
Pacific silver fir	111	21.6	7-44.5	11.1	0-60	10.0	0-95	101.7	37-169
W. white pine	89	16.1	6-32.3	8.3	0-55	34.7	0-97	79.4	25-135
Port Orford cedar	70	23.7	5-60	17.2	2-80	14.6	0-98	84.5	24-152
Incense cedar	54	23.2	5.7-59	18.4	0-60	16.8	0-92	80.6	27-187
Western redcedar	39	21.6	5-41	9.9	0.5-35	24.0	0-99	85.0	35-145
Subalpine fir	33	14.4	7-39	7.5	0-23	33.7	0-95	63.4	26-117
Nootka cypress	26	12.1	7.3-24.5	4.0	0.5-46	1.7	0-20	73.2	48-98

Summary of some tree characteristics by species.

Results & Discussion

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

This information will be used to evaluate the accuracy of existing tree-survival models and to build a model for predicting survival of most dominant tree species in Oregon and Washington.

This effort will lead to development of 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.

The products to be generated by this effort are:

1) evaluation of existing models to predict survival of trees after fire in the western United States;

2) validate or revise Scott et al. (2002) with empirical data;

3) Produce a model for most tree species in R6 to assess tree survival after 3 years; and,

4) Assess survival 5 years after fire injury.

Rating bark and ground char.

Literature Cited

Scott et al. 2002. Factors affecting survival of fire injured trees: A rating system for determining relative probability of survival of conifers in the Blue and Wallowa Mountains. BMPMSC-03-01. 72pp.