

Delayed Tree Mortality Following Fire in Western Conifers

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Project Summary

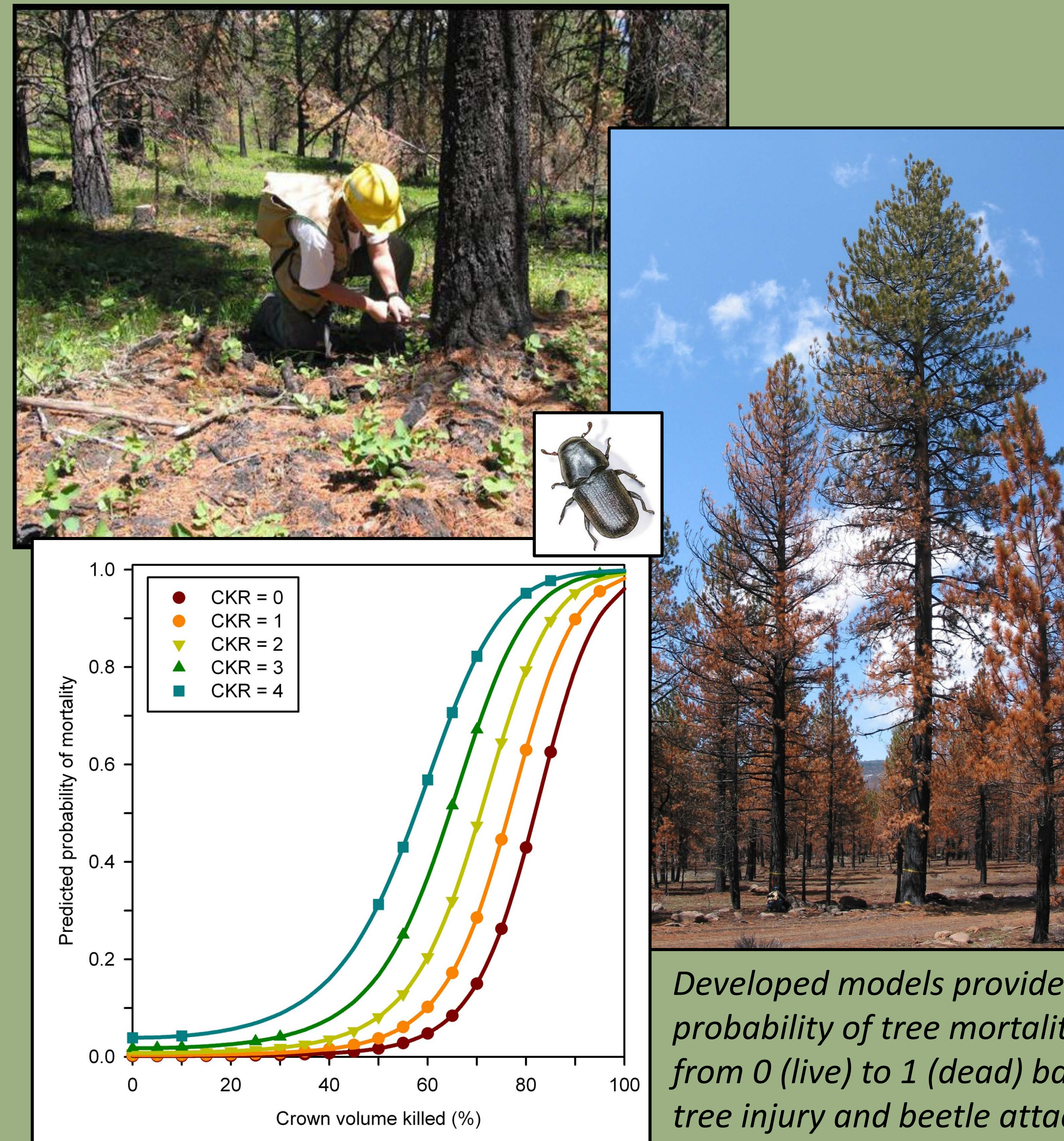
We developed models that predict mortality of 12 western conifer species 3 years post-fire by pooling data collected from several fire-injury studies. Two sets of models were created for each species, one for use in pre-fire planning, which used only crown injury and DBH as potential variables, and a second, optimal model for use in post-fire planning that used all significant variables. Predictive accuracy of all models was compared to the accuracy of the mortality model used in the First Order Fire Effects Model (FOFEM) prior to 5.7, BehavePlus, and the Fire and Fuels Extension to the Forest Vegetation Simulator (FFE-FVS). These new models are in FOFEM 5.7 and BehavePlus 4.5, with expanded options for predicting mortality in FOFEM. We also examined the accuracy of bark char codes to predict cambium death after fire and made management recommendations for when it is appropriate to use bark char codes in place of direct cambium sampling.

Species Included:

- Lodgepole pine
- Whitebark pine
- Engelmann spruce
- Red fir
- Subalpine fir
- White fir
- Incense cedar
- Ponderosa pine
- Jeffrey pine
- Douglas-fir
- Western larch
- Sugar pine

Important variables for predicting post-fire tree mortality:

- Crown scorched and killed (%)
- Cambium Kill Rating (CKR) or bole char
 - CKR = number of dead cambium quadrants at tree base
- Bark beetle attacks



Developed models provide probability of tree mortality from 0 (live) to 1 (dead) based on tree injury and beetle attacks.

Management Implications

- FOFEM 5.7:
 - Offers improved accuracy in predicting mortality of 12 western conifers 3-years post-fire .
 - Crown scorch most important variable in predicting mortality
 - Cambium Kill Rating (CKR) and beetle attacks also significant
 - Tree size not significant for most species.
 - Allows users to directly enter crown scorch, CKR, and beetle attacks to improve model accuracy.
- Other findings:
 - Tree injury from direct sampling of cambium does not increase post-fire ponderosa pine mortality.
 - Moderate bark char is not a good predictor of cambium kill for species with thick bark
 - FOFEM prior to version 5.7 overpredicts mortality in incense cedar, western larch, and red fir forests and underpredicts mortality of western hemlock.

Products

- Hood, S. M.; McHugh, C.; Ryan, K. C.; Reinhardt, E.; Smith, S. L. 2007. Evaluation of a post-fire tree mortality model for western US conifers. International Journal of Wildland Fire. 16: 679-689.
- Hood, S. M.; Cluck, D. R.; Smith, S. L.; Ryan, K. C. 2008. Using bark char codes to predict post-fire cambium mortality. Fire Ecology. 4: 57-73.
- Hood, S. M.; Bentz, B.; Gibson, K.; Ryan, K. C.; DeNitto, G. 2007. Assessing post-fire Douglas-fir mortality and Douglas-fir beetle attacks in the northern Rocky Mountains. Gen. Tech. Rep. RMRS-GTR-199, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO. 31 p.
- Software updates to FOFEM and BehavePlus



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