

Western Ecological Research Center

Publication Brief for Resource Managers

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Resistance of Small Trees to Fire-caused Stem Damage

Prescribed fire is commonly used to thin overly-dense forests and promote forest health. Understanding how fire may result in tree death depends on knowing exactly how fire causes damage to plant tissues. In a study recently published in the journal *Forest Ecology and Management*, USGS scientist Dr. Phil van Mantgem and co-author Dr. Mark Schwartz at the University of California at Davis, demonstrate how heat stress from fires overcomes the protective layer of bark to damage the conductive tissues of trees (i.e., the living cells in the stem). The study focused on small trees, which are often a target of management actions.

The authors found significant differences in the level of bark protection in small trees, measured in terms of bark thickness, for several species common to mixed conifer forests of the Sierra Nevada (Douglas fir, incense cedar, ponderosa pine, and white fir). However, species differences in bark thickness did not translate into large differences in the temperatures experienced by conductive tissues for similar-sized trees during fire simulations. Thin-barked species had bark physical properties that appeared to compensate for lack of bark thickness, so the species were found to have a similar degree of stem heat resistance. Seasonal differences between the spring and fall burning seasons did not appear to have an effect on stem heat resistance.

The crowded, closed-canopy conditions of today's forests may allow shade-tolerant white fir and incense cedar to rapidly grow to large sizes and develop thick bark. Growth projections showed that some shade-

Management Implications:

- Differences in bark thickness among species do not necessarily translate into large differences in stem fire resistance for small trees. Hence, it may prove difficult to selectively remove particular species via stem damage using prescription burning.
- Conducting prescribed burns in the spring or fall may not have measurable differences in terms of stem heat resistance.
- Shade-tolerant species may achieve some level of stem fire resistance within 50 years under current closed-canopy conditions.

tolerant species may attain at least a degree of fire resistance for tree stem tissues in as little 50 years.

van Mantgem, P., and M. Schwartz. 2003. Bark heat resistance of small trees in Californian mixed conifer forests: examining some model assumptions. Forest Ecology and Management 178:341-352.