Lowering stand density reduces mortality of ponderosa pine stands

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As trees grow larger in even-aged stands, competition develops among them. Competition weakens trees, as they contend for soil moisture, nutrients, and sunlight. Competition also increases trees' risk to bark beetles and diseases, and subsequently leads to a buildup of dead fuels. A recent study, led by Dr. Jianwei Zhang, research forester at the U.S. Forest Service's Pacific Southwest Research Station, considered if the onset of this risk could be determined. The study, which appears in the *Canadian Journal of Forest Research*, also considered if the relationship between density and mortality varies with site quality as ponderosa pine stands developed.

Based on the analysis of 109 long-term research plots established on even-aged natural stands and plantations from 1944 to 1988, and 59 additional ponderosa pine plots measured by the Forest Service's Forest Inventory and Analysis group, these researchers found that site quality affected the relationship between density and mortality.

"Any silvicultural treatments that enhances growth will reduce mortality rate for a given stand density." Dr. Zhang said. "By establishing the self-thinning boundary lines from the size-density trajectories, the onset of mortality risk can be determined for ponderosa pine stands."

The research also confirmed the added value of such long-term study sites which allow new questions to be addressed that were not included in the original studies. Other recently published research from this group of scientists demonstrated thinning forest stands to a lower density

reduces fuel buildup significantly, and enhances its economic value by increasing growth of residual trees. Specifically, stand basal area, which is the cross sectional area of all trees in a stand measured at breast height, is not affected by thinning ponderosa pine stands to half the normal basal area of a specific site quality. If the stand has experienced high mortality caused by bark beetles, it can be thinned more heavily without sacrificing timber, biomass, or volume increment and plant diversity.

In addition, results from these long-term studies show that early shrub removal and tree density control are the most effective and efficient ways to reduce fuel buildup. Under Mediterranean climatic conditions, shrubs reduce overstory tree growth and keep tree crowns in contact with the shrub canopy. In turn, this growing fuel ladder can carry a ground fire into the crowns of the overstory trees. Although carbon stocks may be the same with or without understory vegetation, by controlling competing vegetation, carbon is reallocated into the trees instead of shrubs; and carbon loss to wildfire is reduced.

These findings provide useful information for managers in their stand treatment projects within National Forest and private forestlands.

More information: treesearch.fs.fed.us/pubs/45108;

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