Northwest Fire Science Consortium
A JFSP KNOWLEDGE EXCHANGE CONSORTIUM

MOUNTAIN PINE BEETLE AND FIRE BEHAVIOR

FUEL DYNAMICS IN SOUTH CENTRAL OREGON LODGEPOLE PINE

RESEARCH BRIEF 4 • SUMMER 2014

The mountain pine beetle is a native insect present in most pine stands in the United States. However, beetle populations can quickly balloon and causes extensive tree mortality when conditions are suitable, as has been occurring in south-central Oregon over the past 30 years. In a 1986 peak more than 1,000,000 infested acres were detected. Mountain pine beetle activity peaked again in 2008 to 2009, with over 400,000 infested acres. The extensive amount of dead fuel created by these outbreaks, combined with future climate change effects, has raised questions about the potential for severe wildfire. These questions, however, are difficult to assess due to the lack of specific data concerning how mountain pine beetle-caused mortality influences fuels and affects fire behavior.

Darci Carlson, U.S. Forest Service

Lodgepole pine mortality from mountain pine beetle

To determine the influences of mountain pine beetle epidemics in lodgepole pine forests in south-central Oregon, researchers looked at how ground, surface, ladder, and crown fuels change over time in response to beetle epidemics, and how these epidemics influence current and future fire behavior. By looking at similar stands of varying ages researchers documented changes in stand development and fuels over time and developed a chronosequence covering a range of post-beetle epidemic conditions. Fire behavior was determined at multiple scales using several standard fuel models.

Carrie McDermott, Resource Advisor

Fire in the Fremont-Winema National Forest.

Lodgepole pine in south-central Oregon

Mature lodgepole pine (Pinus contorta) forests of the Deschutes and Fremont-Winema National Forests in south-central Oregon are generally low productivity, single-species dominated, uneven-aged stands, with mixed-severity fire regimes. These forests are unique in that seed release from the cone is not triggered by fire (serotiny), as it is with lodgepole pine in other parts of Oregon and Washington. As a result, the relationship between fire and seed production is different than in areas where serotiny is an important ecological factor in lodgepole pine regeneration. Due to the soils and topography in central Oregon, the composition of lodgepole pine forests in this area tends to remain unchanged even when stands are disturbed. Therefore the fuel characteristics associated with changes in vegetation within these stands are unique as compared to other regions.

The Northwest Fire Science Consortium is a regional fire science delivery system for disseminating knowledge and tools, and a venue for increasing researcher understanding of the needs of practitioners.

KEY FINDINGS

- The Mountain Pine beetle influences the organization of fuels over time, and these changes can be identified as four distinct stages:

1. Overstory mortality stage (red stage) – 2 to 4 years after beetle epidemic. Characterized by a mix of red needled dead and living green trees
2. Standing & falling snag stage (gray stage) – 5 to 13 years after beetle epidemic. Characterized by gray standing snags that fall slowly through this stage, with an increased number of snags falling near the end of the 13 years.
3. Regeneration stage – 14 to 25 years after beetle epidemic. The most noticeable change in this stage is the dramatic increase of seedlings and saplings, which increases the amount of live, woody fuel.
4. Overstory re-initiation stage – 26 to 32 years after beetle epidemic. Characterized by the closing of the stand canopy, as the trees that survived the beetle attack mature. Shrubs begin to decline at this stage.

- Following a mountain pine beetle epidemic in south-central Oregon, structure of the forest changes such that fuel characteristics result in a slower moving fire of less intensity in the years immediately following a mountain pine beetle epidemic, but after 6-10 years, the speed and intensity increases until about 28-30 years, when it declines again.

- The density of available fuels in the tree canopy declines significantly 2 to 4 years after a beetle epidemic, and slowly recovers over the following decades.

- Forest litter, 1-, and 10-hour fuels change little from year 2 to year 32.

- The 100-hour fuels slowly increase from year 2-4 due to overstory mortality, and continue climbing for decades.

- The 1000-hour fuels begin to decrease at the end of the overstory re-initiation phase; ~ 32 years.

Fuel types

1-hour fuels
Dead herbaceous plant and woody material less than ¼ inch in diameter, as well as uppermost layer of leaves and needles on the forest floor

10-hour fuels
Dead round wood ¼ to 1 inch in diameter, and the layer of litter up to ¾ inch below the surface of the forest floor

100-hour fuels
Dead round wood 1 to 3 inches in diameter, and the layer of litter extending from ¾ to 4 inches below the surface of the forest floor

1000-hour fuels
Dead round wood 3 to 8 inches in diameter and the layer of the forest floor more than 4 inches below the surface

MANAGEMENT IMPLICATIONS

- Fuels treatments and restoration may be most appropriate within 5-13 years following beetle epidemics, prior to the majority of snags falling. After 12 years most of the available fuel is on the ground and the regeneration of conifers and shrubs, responding to changes in available nutrients, create more surface fuels.

- Opportunities to use prescribed fire to treat fuels may decrease during the regeneration phase of 14-25 years post beetle, as 1000-hour fuels accumulate after snags have fallen.

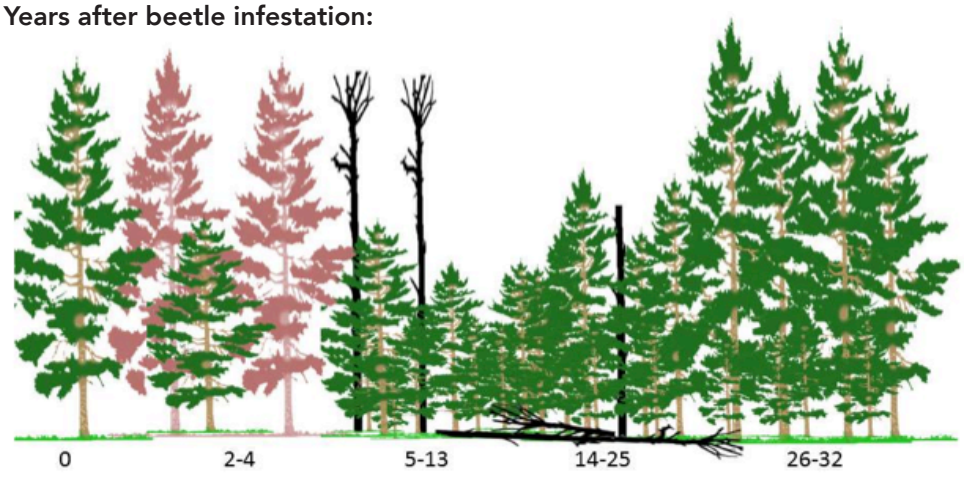
- Land managers with beetle-affected lodgepole pine stands in south central Oregon can use these results to plan forest and fire management activities that achieve desired conditions based on current conditions and forest structure progression following pine beetle infestations.

MORE INFORMATION

View the full Joint Fire Science Program report:
http://www.firescience.gov/projects/09-1-06-17/project/09-1-06-17_final_report.pdf

Contact: *Dave.Shaw@oregonstate.edu*

Years after beetle infestation:



This research brief was funded by the Joint Fire Science Program.