



Fire Science: Quick Takes

Mountain Pine Beetle and Wildfire Risk

The mountain pine beetle has killed 1.5 million acres of lodgepole pine in Colorado alone since 1996, and in 2007 the beetles killed an estimated 3.9 million acres of lodgepole pine across the Rocky Mountain region. The extent of beetle kill has raised concerns that the risk of catastrophic fires is spreading along with the outbreak. A series of studies is starting to shed light on how this infestation will play out in terms of wildfire risk over the next decades:

- The risk of ignition in lodgepole forests likely goes up in what is called “the red phase” after lodgepole pines are attacked and dead, dry needles are still on the trees, but that only lasts for 1 to 3 years after the tree is attacked. In “the grey phase,” characterized by dead standing trees with no needles, the risk of ignition and the risk of crown fires actually go down, and that lasts for 10 to 20 years after the tree is attacked.
- The real fire risk comes when the trees start falling down to the ground—about 20 years after attack—and you get the build-up of the thousand hour fuels—those are the fuels that burn hot and can become difficult to control. Fire risk is always high in lodgepole systems even before they are impacted by beetle outbreaks.
- Researchers looked at a beetle outbreak in the 1940s that wiped out 90 percent of spruce-fir forests in northwest Colorado, and they did not find an increase in fire occurrence in the beetle kill forests. The general explanation is that these high elevation spruce-fir forests are dependent on exceptional drought to burn, which doesn’t come along very often.
- The current beetle outbreak is primarily affecting lodgepole pine forests in Colorado and other parts of the Rockies and lodgepole forests are very different from spruce-fir. Surprisingly, though, outbreaks do not dramatically increase the risk of more frequent or more severe fires in either forest type.
- Unlike many other forests, the dense stands of lodgepole pine found throughout the Rocky Mountain region are not an artifact of fire suppression. Historical research shows that these stands have always burned infrequently under large, severe “stand replacement” fires that are followed by the development of young dense stands. The infrequent, large, severe fires have led to a distinctive even-aged structure in lodgepole. The forests tend to be relatively uniform in size with little understory or “ladder fuels” that can carry fires into the canopy.
- Old-growth, spruce-fir forests in contrast, have a much more mixed structure. There are lots of dead and down trees—ladder fuels—in these forests. These forests also seem primed for large fires, but they burn infrequently, and when they do burn, the cause is more likely to be extremely dry weather conditions than any build-up of fuels, either from a beetle outbreak or from natural cycles. These forest systems have to be dry to burn, and when they are dry it doesn’t matter if the trees are green or dead—they will burn hot.
- While beetle outbreaks are relatively common in lodgepole, they are rare in the higher elevation pine forests due to the cold temperatures. And, unlike lodgepole forests which have adapted to

the beetles, the slow-growing whitebark pines only have the cold temperatures at high elevations to help them fend off the beetles. However, warming temperatures in the West have taken away even that defense.

- Warmer temperatures are allowing adult beetles to reproduce in the summer, and then survive the winter to reproduce again the following spring. This is vastly increasing their reproductive potential.
- Lodgepole forests are resistant to large scale disturbances and researchers expect that within a century or two lodgepole will bounce back and occupy its present range once again. However, the high elevation whitebark pines have not historically been subjected to these types of disturbances. Whitebark pines depend on Clark's nutcracker seed caches for reproduction, and this could be lost if the bird switches to another food source.
- No one knows how long the current outbreak will last. It all really depends on climate. If the warming trend continues, the outbreak is likely to continue until the food source is gone. If cold temperatures return to Rocky Mountains, then the outbreak could be slowed and stopped. So, the options for slowing the outbreak itself are almost nonexistent, but there are options for dealing with the fire threat including creating buffers around communities that are likely to be impacted by fires.

More Resources:

- Romme et al. 2007. Recent Forest Insect Outbreaks and Fire Risk in Colorado Forests: A Brief Synthesis of Relevant Research. Colorado State University-
http://www.cfri.colostate.edu/docs/cfri_insect.pdf
- Dominik Kulakowski, Thomas T. Veblen (2007) Effect of Prior Disturbances on the Extent and Severity of Wildfire in Colorado Subalpine forests. Ecology: Vol. 88, No. 3, pp. 759-769.
- Peter Bebi, Dominik Kulakowski, Thomas T. Veblen (2003) Interactions between Fire and Spruce Beetles in a Subalpine Rocky Mountain Forest Landscape. Ecology: Vol. 84, No. 2, pp. 362-371.
- McDaniel. 2009. Wildfire and Beetle Kill Across the Rocky Mountains. Advances in Fire Practice Website. <http://www.wildfirelessons.net/Additional.aspx?Page=141>

***Advances in Fire Practice** is a sub-site of [wildfirelessons.net](http://www.wildfirelessons.net) and is focused on bringing efforts and ideas to the forefront that leaders in the fire management, practice, and research communities have identified as innovative and widely applicable. It provides access to critical and proven fire information and resources. **Advances in Fire Practice** section can be reached directly by going to <http://www.wildfirelessons.net/AFP.aspx> or through the main Wildland Fire Lessons Learned Center website at www.wildfirelessons.net.*

***The Wildland Fire Lessons Learned Center** actively promotes a learning culture for the purpose of enhancing safe and effective work practices in the entire U.S. wildland fire community. It is located at the National Advanced Fire & Resource Institute in Tucson, Arizona.*

