**Mountain Pine Beetles Expansion in the West**

**Video Notes:**
1) How do mountain pine beetles kill trees?

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Mountain pine beetles (MPB) have been killing trees for millennia. Lake cores composed of layers of dust, pollen and other airborne materials deposited over time on the surface of lakes reveal records of the beetle’s existence in western forests extending back at least 12,000 years. The beetles have likely been co-evolving with western pines for as long as these forests have existed.

Regardless, the replacement of green landscapes with great expanses of red and gray during outbreaks is intensely disturbing. Furthermore, headlines repeatedly fuel emotions by pronouncing that beetles “destroy” forests, insinuating a frightening permanence to the damage. But is this true? We know pine forests have experienced MPB outbreaks in the past and regenerated, often with renewed vigor. When beetle outbreaks follow normal patterns and occur within the bounds of historical variation, they do not destroy, but rather support a forest’s long-term structure, function and resilience.

Yet, this time, something is different. For the first time, pronouncements that beetles destroy may have real meaning for some affected forests.

What makes this time unusual? Due to climate change, western forests are now experiencing warmer summers and winters, and it is warmer longer shifting MPB populations from natural to unnatural. The current outbreak’s size and severity is unprecedented. It is more than 10 times larger than any other known MPB outbreak and is still expanding. In fact, it may be the biggest forest insect outbreak on Earth in recorded history.

Perhaps most unsettling, the MPB has moved into new territory. In British Columbia, the beetle has killed more than 37 million acres of pine. The beetle has expanded its geographic range hundreds of kilometers further north and breached the historical geoclimatic barrier of the northern Rocky Mountains, spreading across portions of Alberta. In these new territories, the beetle is an exotic and is now encountering a new species of pine, the jack pine. From many global examples of exotic insects and native trees interactions, the fear and expectation is that the beetle will continue its expansion across the continent over time until it meets up with eastern pine forests. How MPB will affect these boreal forests or our eastern forests, if they continue to expand, is unknown.

1. How is climate change enabling the spread of the Mountain Pine Beetle?

One expansion of the beetle into new territory is already producing serious trouble for one of the West’s most ecologically important and iconic forests. In recent years, the beetle has moved upslope into high elevation subalpine forests of whitebark pine. Mortality has been so severe and widespread that the U.S. Fish and Wildlife Service recently ruled that the tree warrants listing as endangered, although actual listing was precluded due to lack of funds.

In the past, the subalpine — one ecosystem where whitebark pine grows — has typically been too cold for the beetle.  For the MPB to thrive, it must complete development in one year. Adults must emerge and subsequently attack and lay their eggs in trees in mid-to-late summer to allows the eggs sufficient time to hatch and enter winter as larvae — the only stage of their development in which they can withstand subfreezing temperatures. Historically, beetles that found their way into high elevations took more than one year to develop due to cooler conditions and shorter growing season. This resulted in high levels of beetle mortality as most entered winter in stages other than the larval stage and were killed while harsh winters caused additional mortality in some larvae. However, the subalpine has now warmed sufficiently to support at least one-year life cycle. In some places, winters have even warmed sufficiently to allow parent adults — normally killed by low temperatures — to survive throughout the winter and initiate new attacks in spring. While there have been some reports of MPB in high elevations reproducing twice in a single year, models and field observations indicate that temperatures have not warmed sufficiently to support that theory. Instead, the two periods of attacks being observed are likely the result of an early flight of surviving parents in spring, followed by a later flight of their young in summer.

1. How is climate change affecting the life cycle of the Mountain Pine Beetles?

MPB outbreaks in whitebark pine are not new. Smaller outbreaks occurred in the 1930s and 1980s. However, these were limited to short periods of anomalous warm temperatures. When normal cooler conditions returned, beetles were killed and outbreaks ended. Unfortunately, because the current outbreak, which started around 1999, appears to be driven by climate change, thermal conditions supportive of the MPB will continue for the long term. Cold snaps in the fall or in late spring that could cause beetle mortality at high elevations are becoming less common. This means beetles are no longer transient visitors to the subalpine, but permanent residents.

While warming has allowed the beetle to move into subalpine forests, other factors appear to exacerbate its effects now that it is there. Pines fight beetle attacks by pitching out resin that can drown or flush attacking beetles out of trees. Unlike lodgepole and ponderosa pine, whitebark pine produces little to no resin, and is easily overwhelmed. In addition, the beetle kills and reproduces in a wider range of sizes of whitebark than it does in other pines. Lodgepole pine must be at least twenty centimeters in diameter for MPB to reproduce, but whitebark pines as small as 13 centimeters in diameter can support relatively high productivity of the insect. This means that not only mature trees, but also the smaller ‘replacement’ whitebark pines are killed.

The situation with MPB and whitebark pine is dramatic but not unique. It is one of many cases of tree die-offs that are occurring around the globe. Unfortunately, as warming continues we can expect to see more trees and ecosystems at risk. We cannot only treat the symptoms — like the beetle — but must also address the underlying condition of climate change to be effective. By restoring our forests and cutting our use of fossil fuels, we can begin to reduce negative impacts of warming on our forests. It can never be too early to start, only too late.

1. How can the activities of the beetles exacerbate climate change (hint: think about how destroying trees may affect the climate)?

**Research the answer to the following questions:**

1. What are fire -suppression policies?
2. How could fire suppression policies affect the mountain pine beetle activity?

6) How can the destruction of mature trees affect a forest ecosystem?