Are peninsula beetle-killed trees rotting faster than they used to?

by Ed Berg

I am puzzled about how fast beetle-killed spruce trees are coming down. Every windy day seems to bring power outages somewhere around the Peninsula as dead spruce trees fall on power lines.

Most of these treefalls are caused by breakage of the tree trunk rather than uprooting of the whole tree. The trunks are simply snapping off several feet above the ground.

If you look at the fractured wood in the broken zone, you can often see white threads and felt-like sheets of fungal fibers called mycelia. This is a sapwood rot fungus called pinicola conk or red belt fungus (*Fomitopsis pinicola*), which typically infects wounded live trees or dead trees. There are many species of wood rot in the Kenai forests, such as artist's conk (*Ganoderma*) and the tasty orange sulfur shelf or chicken-of-woods (*Polyporus*), but the red belt fungus is by far the most common wood rot, especially on beetle-killed spruce.

Mushrooms and wood rot fungi first produce a vast unseen network of mycelia fibers in their host (soil or wood), and then produce a fruiting body, which makes spores for reproduction. Mushrooms are the fruiting bodies of soil and some wood fungi, and as mushroom hunters well know, these fruiting bodies are ephemeral and only appear for a few weeks after a wet period.

Wood rots, however, produce a permanent woody conk, which is typically a round bulbous or shelf-like structure several inches wide growing on a tree trunk. The conk of the red belt rot fungus is shelf-like to hoof-shaped, and has a banded appearance. Some specimens have a dark red lower band, and hence the name "red belt," whereas other specimens are gray to black with no red. The lower surface is white to buff with minute pores, which emit spores.

Conks don't appear until the rot is well established, which can take at least three or four years after a tree is killed by beetles. By the time you see conks on a tree, it is often quite rotten inside and dangerous to cut with a chainsaw, because the tree may fall before you have completed the cut.

This may be just an impression, but I think that our dead spruce trees are rotting much faster today than they did in the past. For example, in 1995, Chris Fastie and I collected 450 "cookies" (tree cross-sections) from the new Bufflehead Road on the north side of the Swanson River oilfield. We went along with the sawyers and they cut a cookie off the bottom of each tree (both white spruce and birch) after they felled it.

Many of the trees were standing dead spruce that had been killed in the beetle outbreak that followed the drought of 1967-69. Most of the bark was gone and you could plainly see the beetle scars. When we cross-dated the tree-rings, we could see that many of the trees died in 1970 (and that they had survived earlier beetle attacks in the 1850s and early 1900s).

The key point for this discussion, however, is that many (perhaps half) of the trees were still standing, even after 25 years, and the wood was sound, not rotten.

I spoke with former logger and saw miller Tim Smith, whose family has been logging out of Cooper Landing since the 1960s. He recalled logging beetle-killed spruce after a big 1974 blowdown in Cooper Landing, and said that the dead trees at that time were not rotting anywhere nearly as fast as the present beetle-kill in the forest.

Here is an even more extreme example: in the summer of 2001 we cored standing beetle-killed trees from the 1930s in Kluane National Park in the Yukon. The wood was hardly rotted at all, although the bark had long since fallen off. The Yukon has a dry climate: Haines Junction has 12 inches annual precipitation, whereas Kenai has 19 inches and Homer has 25 inches. It was a great pleasure to do our tree-ring studies over there because we had solid wood, and we were able to date burns to 1721, 1750, 1758 and 1850 (give or take a year or two) using unrotted burned wood.

I proposed my idea about accelerated Kenai rot rates to Mark Harmon, a visiting professor from Oregon State who is starting a research project on wood decomposition on the Kenai. He suggested that the warmer summers of the last decade might be responsible.

Mark drew the analogy of a wooden fence post: exactly where does a fence post become rotten? The rot occurs right at the soil-air boundary, where the post experiences both wetting and warming. The belowground part stays permanently damp and cool, and the aboveground part dries quickly after a rain. The collar at the soil-air boundary, however, wicks water from below and from the surrounding vegetation, but it is warmed by the surrounding air temperature.

Warm and wet is the perfect fungus combination, so that is why fence posts rot off at the ground level.

On this interpretation, the warmer summers may simply be providing a few degrees more heat in the summer, and the rot fungi have cranked up production. One test of this hypothesis would be to look at other fungi, such as soil mushrooms and athletes' foot, to see if these fungi have also increased in the last decade.

An additional factor might be that spore production and dispersal has greatly increased. Each conk on dead spruce produces billions of spores, and more conks are appearing every year. Each spore that somehow penetrates the bark can start a new rot infection in a host tree.

Bark beetles are known to carry blue stain (Leptographium) fungal spores on their bodies, so they probably carry various rot fungal spores as well. Other insects such as woodborers and carpenter ants, and even woodpeckers that attack dead trees, could also be vectors for spore dispersal.

Furthermore, the open dead forest canopy should allow wind to move spores around more effectively, and there certainly are plenty of holes in the beetle-killed trees through which spores might enter.

Regardless of whether or not our trees are rotting faster nowadays, it is probably a good thing that they are rotting as fast as they are rotting. We have a lot of dead wood to get rid of around here, all politics aside. The fire hazard of trees is greatly reduced with rotting, and it appears that our dead fuel load is rotting away at a much higher rate than it did after the outbreak of the 1970s.

Ecologically speaking, tree rot is every bit as important as tree growth. As I discussed in a recent Refuge Notebook article, rotten wood produces the nurse logs and nurse stumps upon which seeds of the new forest germinate.

This is especially important in areas covered by thick grass sod or heavy moss ground cover. In mature white spruce and Sitka/Lutz spruce forests of the Kenai, you can see that many of the trees germinated "up in the air." The roots are forked at the base of the tree, and there is often a hole under the tree.

If you are brave and stick your hand down into this hole, you can often bring up the old rotten wood upon which the present tree germinated and took root.

When we examined hundreds of throw mounds of blown over trees in the logged areas of the central Peninsula, we found old nurse wood under most of these trees, both white/Lutz spruce and birch.

On the longer time scale, we know from the pollen record in lake sediments that white spruce came into the central Peninsula about 8,000 years ago, and that Sitka spruce came into Kachemak Bay about 2,200 years ago. If we figure that these forests are substantially thinned every 100 years or so by bark beetles (and much less frequently by fire), we might say that 80 generations of forests have come and gone in the central peninsula and 22 generations in Kachemak Bay.

Can you imagine what this place would look like if those trees never rotted, or what kind of fires we might have with such a fuel load? Let's hear three cheers for the wood rot fungi!

Further information on wood rot and bark beetles can be found in the Forest Service's excellent manual *Insects and Diseases of Alaskan Forests* (2001) which is now available online with color photos at http://www.fs.fed.us/r10/spf/fhp/idbook/

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