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What happened to the trees?

As you travel through the spruce/fir forests on the Markagunt Plateau, you will see thousands of dead and dying Engelmann spruce trees. These trees have been killed by the spruce bark beetle. These tiny insects, like fire, act as a natural agent of forest renewal.

Spruce Bark Beetle

The spruce bark beetle (*Dendroctonus rufipennis*) is native to the spruce/fir forests of the Markagunt Plateau, and to many other spruce forests throughout the world. Generally the beetle population is small (endemic) with beetles preferring downed trees in areas of windfall, logging, or other ground disturbing activities.

These insects live most of their lives under the bark of spruce trees. Adults bore through the bark of the tree and lay

their eggs in the cambium layer, just under the bark. This is the layer that transports water and nutrients between the leaves and roots of the tree. As the eggs hatch, the beetle larvae feed on the cambium tissue, cutting off the supply of nutrients to the tree, and killing it.

When the beetles reach adulthood, they emerge from the tree and fly off to infest other trees.

Can the trees fight back?

When a healthy spruce tree is attacked by beetles it has an effective natural defense-sap. When a beetle bores into the bark, the tree begins to produce excess amounts of sap which is released into the holes bored by the insects. Normally, the sap kills the beetle and seals the wound.

However, under epidemic conditions, when thousands of beetles infest a single

tree, the tree's defense mechanism is ineffective. The needles of a beetle-infested tree will turn light green to yellow after the first year of the infestation, then turn brown after the second year. The needles have usually dropped by the third year following the initial infestation.

How did the beetles reach such epidemic levels?

Although the spruce bark beetle has always been a part of the spruce/fir forest ecosystem, the most recent research indicates that a fungal root disease may have affected the overall health of this forest, and made the trees more vulnerable to beetle attack.

Under natural conditions, periodic fires burn through the forest and suppress growth of the fungus that causes this disease, so the trees remain healthier and can defend themselves against the beetles. A century of fire suppression has allowed the fungal root disease to progress, weakening the trees so they are less successful in their defense. Other forest conditions, such as drought and downed

trees from windfall and logging activities have also contributed to the explosion of the beetle population that began in this area about 1992.

Research also suggests that this spruce/fir forest renews itself on a cyclic basis every 300 to 500 years. The natural fire regime usually results in a "stand replacement" fire an average of every 330 years. With the suppression of fire, conditions have developed to allow a different agent of renewal-the spruce bark beetle-to assume its natural role in the cycle of forest succession.

What now?

Although large areas of beetle-killed trees located on the Dixie National Forest will be logged to salvage the timber for log home construction and other uses, large-scale commercial timber harvests will not occur within the boundaries of Cedar Breaks National Monument.

The spruce bark beetle is a native insect and is part of the natural process of forest renewal. The National Park Service is mandated by Congress to preserve natural processes, as far as possible, within parks. Over time, as trees die and fall, the decaying logs provide habitat for many species of mammals, birds, and insects. As the wood decays, nutrients are released into the surrounding soil. The new openings created by falling trees allow sunlight to reach the forest floor, improving conditions for meadow grasses, forbs, and shrubs. These are then followed by “pioneer” tree species such as quaking aspen. As the aspen grow tall and shade the soil, conditions become favorable for the germination of conifer seeds, such as spruce and fir, and the cycle continues.

Another tool of renewal in forests is fire. During a natural fire regime, with short intervals between fires, a wildland fire would normally consume brush and dead materials on forest floors leaving healthy standing trees alive.

Within overgrown, unhealthy forests fires tend to be devastating; consuming all trees and vegetation in the forest. As

individual trees “torch,” the fire spreads along the top of the trees moving rapidly in a crown fire. Crown fires are very difficult to combat, making them the most devastating of all wildland fires.

The associated risks of a dead forest means the park management team must concern itself with the hazards of falling trees in developed recreational sites and unnatural levels of dead and downed wood that could fuel a wildfire. To address these concerns, a Hazard Fuel Management Project has been undertaken to reduce hazard trees and fuel levels around park buildings, recreation sites, along the road corridors, and where park boundaries adjoin private land. These trees were removed during the winter of 2002-2003 after a blanket of snow has been laid down. Snow and frozen ground conditions prevented damage to soils and other vegetation usually associated with tree removal.

In 2005, the National Park Service approved a new fire management plan for Cedar Breaks National Monument that includes the use of fire as a tool for maintaining the health of this ecosystem.