Douglas fir and grand fir attacked by spruce budworms in the Teanaway area. Budworms cause the trees' needles to stop photosynthesizing and turn red. Trees often recover, but can be killed by severe outbreaks. Jim Agar

Why are Trees Dying?

Spruce budworms and mountain pine beetles hit Cascade forests

David Williams
David is a writer and WTA member from Seattle.

Drive over the North Cascades Highway and you cannot miss the acres of sick trees. Starting at about Washington Pass and continuing east, the forests look scorched and burnt. The trees still cling to their needles, but instead of the verdure that defines our region a rusty brown dominates.

The North Cascades area is not alone. Hike up Ingalls Creek or to Tuck and Robin Lakes and you will encounter the same grim picture. Sometimes the damaged trees grow in patches and other times they grow in extended, unbroken swaths. The same applies to areas around Blewett Pass, Twisp River, White Pass and throughout the Wenatchee and Colville National Forests. The Forest Health Highlights December 2007 report—produced by the U.S. Forest Service and Washington State Department of Natural Resources—reports that more than 600,000 acres have been affected in recent years. The main culprits are the western spruce budworm and the mountain pine beetle.

Western Spruce Budworm

"The damage is very ugly but it is not as bad as you think," says Connie Mehmel, a Forest Service entomologist. "Many trees look dead but they are alive." She is referring specifically to the damage caused by spruce budworms. The name is a misnomer. They are not a worm but the larvae of a mottled brown, one-inch-wingspan moth. Nor do they feed primarily on spruce; they prefer to eat true firs and Douglas firs. "What the budworms are doing is eating the new foliage, which eventually turns rusty brown," she says. "They eat from the top down and the outside in. Most trees do survive and recover, though it may take decades."

Western spruce budworm (*Choristoneura occidentalis*) occurs naturally in Washington, Idaho, western Montana and Colorado. A Forest Service leaflet describes the moths as the "most widely distributed and destructive defoliator of coniferous forests in Western North America." Outbreaks such as the present one typically last from 7 to 10 years. Then the moth population collapses due to starvation, although an epidemic in the northern Rocky Mountains persisted for more than 30 years. Mehmel says outbreaks generally occur during droughts but entomologists don't fully understand the mechanism.

The spruce budworm life cycle begins when an adult moth lays her eggs on the underside of needles, generally in early fall. First instars, the technical name for lepidoptera larvae, throw out a thread and balloon to a new tree. They do

not feed. During the second instar, they build a tent-like hibernacula and overwinter in it. When they emerge in late May and early June, they are hungry and the 1 to 2-mm long larvae tunnel into new needles, cones, and buds. As the larvae shed skin after skin they continue to grow and to consume new foliage and cones, and by their final instar, they are an inch long and brown, with white dots on their backs. They pupate in early July and their 30 to 40 days of terrorizing trees ends. After ten days, an adult emerges from the pupa. Adults do not feed; they mate and die.

"The spruce budworm outbreaks are natural but they are more frequent and more severe than in the past," says Jim Agee, emeritus professor of forest ecology at the University of Washington. He says that years of fire suppression and little forest thinning have created forests rich in Douglas fir and grand fir. In addition, forest structure has changed so that trees are denser and in continuous layers. In the past, forests were more open and park-like and ballooning spruce budworm larvae had a higher chance of falling to the forest floor, where predators such as birds and ants could devour them. With today's multistory structure and contiguous cover, the larvae fall to the numerous trees below or nearby and start eating when they emerge the following spring.

Younger trees are the ones most susceptible to death by defoliation. They don't have enough foliage to survive an onslaught of feeding. When spruce budworms eat needles, the tree can no longer photosynthesize. Young stands can also suffer if defoliation persists for several years. Mehmel says that mature trees can survive up to 75 percent defoliation, although needle loss restricts growth and can lead to top-killing.

Mountain Pine Beetles

Global warming also makes western forests more susceptible to insect damage, particularly from the other important tree pest, the mountain pine beetle (*Dendroctonus ponderosae*). The generic name means "tree killer," an apt label for an insect that "ranks first in destructiveness among bark beetles of the West," according to Forest Service leaflets and papers. The beetles occur throughout the western states and into British Columbia, where an epidemic far outpaces any in Washington.

The province's cumulative outbreak by 2006 was 51,000 square miles, or the equivalent of 75 percent of the area of Washington. British Columbia has much more extensive stands of lodgepole pine (*Pinus contorta*), one of several pines favored by the pine beetles. (A recent study in the journal *Nature* shows that epidemic tree deaths further exacerbate global warming because the forest changes from a net carbon sink to a carbon source, as the dead trees can no longer absorb carbon dioxide and

Where To Hike: July

Photo by trip report poster "Jennifer S."

Marmot Pass

Location: Olympic Peninsula - East
Distance: 10.6 miles roundtrip
Elevation: 3500 ft. gain to 6000 ft.
Maps: Green Trails #136 Tyler Peak; Custom Correct Buckhorn Wilderness

Why Go?

Marmot Pass is a quintessential Olympic Peninsula hike —from old growth forest and the tumbling Quilcene River to broad meadows of wildflowers and supreme views in all directions, this is a trek well worth making.

Marmot Pass makes an excellent day hike, though it's so beautiful that you may want to consider backpacking. The best way to reach Marmot Pass is via the Big Quilcene Trail #833.1. The trail enters the Buckhorn Wilderness right away, and for the first two miles you walk through towering old growth along the Big Quilcene River. Be sure to notice the forest understory—vanilla leaf, trillium, rhododendrons, thimbleberry, just to name a few. And later in the season—huckleberry!

At 2.5 miles, you reach Shelter Rock Camp and then leave the thick canopy behind. For the next two miles, the trail climbs in and out of forested patches but is mostly in small, enchanting meadows. The trail climbs steadily the entire way, but it never seems too steep.

At 4.5 miles is the charming Camp Mystery, with a few open campsites right on the trail and a few more secluded ones beyond the big site up toward the pass. Backpackers often stop here for one or two nights, using the extra time to hike beyond Marmot Pass to Home Lake, the Tubal Cain Mine Trail or to the top of Buckhorn Mountain.

A large, open meadow takes the trail the rest of the way up to Marmot Pass. The views up top are breathtaking - some of the tallest Olympic peaks, the Dungeness Valley, Hood Canal, the Cascades and more.

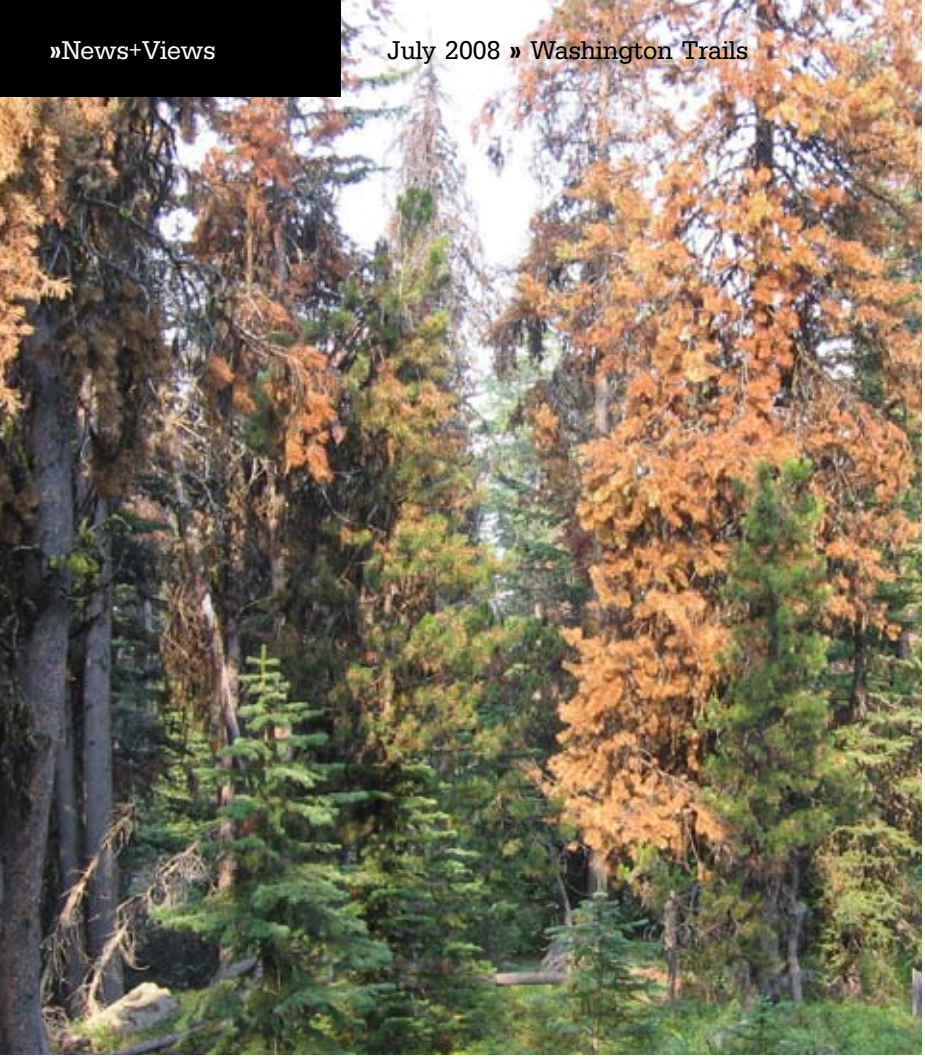
More Information

Call the Quilcene Ranger District, (360) 765-3368, for conditions. **Guidebook:** *Day Hiking Olympic Peninsula* by Craig Romano (Mountaineers Books). **WTA Trip Reports**: Search for Big Quilcene and Marmot Pass.

Driving Directions

From the town of Quilcene, go south on US 101 1.5 miles, and turn right (west) onto Penny Creek Road. At 1.5 miles bear left on Big Quilcene River Road, which becomes FR 27. At about 10 miles, go left on FR 2750, and continue 4.75 miles to the trailhead at 2,500 feet elevation.

Find more hike ideas online at www.wta.org



Connie Mehmel

Damage to lodgepole pines from western pine beetles at Beaver Lake in the Methow Valley. Pine beetles attack the cambium, between the bark and wood, cutting off nutrients and killing the tree.

now release hundreds of millions of tons of the greenhouse gas.) *Continued on p. 12...*

Increased temperatures affect the beetles three ways. First is that cold can kill the larvae, but winters lately have been too warm to kill. Second is that warmer summer temperatures lead to synchronous emergence of larvae, resulting in a mass attack of beetles. A third problem, notes Forest Service plant pathologist Jim Hadfield, is that increased temperatures have allowed the beetles to move up in elevation and attack and kill whitebark pine (*Pinus albicaulis*).

"This has major ecological ramifications, because whitebark pines establish themselves under harsh conditions. Once established they create a protected habitat that allow subalpine fir to start growing," says Hadfield.

In contrast to western spruce budworms, mountain pine beetles kill trees. They do so by boring tunnels under bark, hence a common name of bark beetle, and feeding on the tree's food-conducting tissue. Tunnels are vertical and can be up to nine feet long with larval galleries verging out at right angles. Death occurs because an infestation girdles the tree and nutrients cannot move from the roots to the crown. Infected trees also lose the ability to transport water because of fungi carried by the beetles that attack the tree. The fungi turn the sapwood blue.

A beetle infestation may not be immediately apparent because beetle tunnels are not visible. A key early sign is the presence of pitch tubes, cream to reddish accumulations of tunnel dust-rich resin on the bark exterior. Also look for boring dust at the tree's base, as well as bark-free areas created by woodpeckers in search of beetles.

Because the beetles operate under the bark they are seldom seem. Adults are stout and black, about one-sixth to one-quarter inch long. Larvae, about the same size as the adults, are pale white grubs. Both larvae and adults damage trees by boring, although adults are more destructive. "They are neat little beetles," says Agee. "They send out a pheromone to attract other beetles and then emit another pheromone basically saying 'This tree is full up.'"

What Next for Forests?

Land managers have no easy solution for combating pests such as spruce budworms and bark beetles. Chemical spraying is too dangerous because it can kill other insects and animals, though the Forest Service is testing spraying pheromones that discourage mountain pine beetles. Such spraying is limited to whitebark pines growing near campgrounds. Controlled burns that thin the forest of small trees can help, particularly in site-specific situations. Selective harvesting of trees also can restrict the insect spread. Foresters cut out younger trees and remove older ones to create the more open stands of the past. Both the Department of Natural Resources and the Forest Service have tried limited forest thinning.

From a hiker's point of view, Jim Agee has two warnings. Five to ten years after an outbreak of mountain pine beetles, when trees have lost their needles, they are more susceptible to wind-caused damage.

"If I were hiking in an area like this, I would keep looking up and not just down at my feet," he says. Of more concern is hiking in an area within a year or two of tree death, when the needles still cling to the trees.

"If I smelled smoke, I would get out quick," says Agee. In such an area, fire can whip through the crowns very quickly.

The Forest Service's Connie Mehmel says defoliated trees are no more susceptible to fire. More problematic are the dead trees under the living ones. They provide a ready source of fuel for fire to spread.

On the bright side, this most recent spruce budworm epidemic appears to be on the wane. Budworms did affect more trees in 2006 than in 2007. Perhaps the outbreak will last only a couple more years. The effects, however, will be evident for many years to come. Trees will have dead tops and less foliage down lower. "Trees will look wimpy," says Mehmel.

At least most of them aren't dead, though. ♦