

Bark beetle time again

by Ed Berg

It's springtime in Alaska, and a young man's fancy turns to—spruce bark beetles—what else!? With romance in the air, the beetles are waiting expectantly for several days of 60°F temperatures for their annual mating flight. This is the only time of year that you will see the beetles outside of the tree; at other times you will need to take a stout knife and peel back some bark to see them at work eating the sweet inner bark.

The beetle mating protocol runs something like this: when the weather has warmed sufficiently, the female beetles emerge and fly to nearby live trees, or better yet to recently downed trees. They fly rather clumsily because they really aren't designed for long-distance flight, although they can be carried by the wind for long distances. When a female finds a suitable tree, she releases an aggregation pheromone; this is a chemical attractant that brings other females to the tree. When the females somehow determine that the tree is "full" of beetles (this must be an interesting story in its own right), they release a disaggregation pheromone that says, "the hotel is full," which repels latecomers.

The female beetle bores through the tough outer bark, and begins tunneling through the inner bark or phloem layer, where the sugar is stored. A male enters the burrow, finds the female, and they mate and the male dies. Unlike many insects, spruce bark beetles are monogamous: each parent has only one partner.

The female enlarges the burrow into a vertical maternal gallery three to four inches long and about 3/8 inch wide. She lays approximately 80 eggs along the sides of this gallery. During the summer the eggs hatch and the larvae (white grubs) fan out on both sides of the gallery, eating their way through the phloem. This is the really destructive phase, which essentially girdles the tree, just as effectively as if you took an axe and stripped off the bark all around the trunk.

The phloem layer is the plumbing that brings sugar produced in the leaves (i.e., needles) down to the roots for storage. When the plumbing is cut off, the roots starve and there is no food left to send up topside to the leaves the following spring to grow new leaves and restart the cycle. That is why trees hit by the beetles

last year are now turning into the "red needle" stage. These needles will fall off over the next year, but you can always tell the recent beetle-kill by the red needles.

The Forest Service flies annual surveys over the forests of Alaska, mapping red needle acreage, as well as other kinds of forest pests and disease conditions. I have just received a copy of the Forest Service's annual report of their surveys and it makes fascinating reading for forest watchers (see website below).

So, how is the bark beetle outbreak doing at this point in time? Basically, the outbreak is over and we are down to "normal" background levels of beetle activity. The problem, however, is that "normal" activity will probably be at higher levels from now on. Global warming is a fact of life, especially in the northern latitudes. We have been in a warm summers mode since 1987, with maximum summer temperatures in 1997. It's true that the post-1997 summers have been a shade cooler, by almost 3°F, because the North Pacific sea surface temperatures have cooled somewhat, especially since 1999.

The beetles love a run of warm summers to build up their populations, and they have essentially had a run of warm summers since 1987, the longest run on record, by far. Even with the post-1997 shallow cooling, the primary reason for the decline in bark beetle activity is that they have "eaten themselves out of house and home," especially on the southern Peninsula. That is, they have killed most of the large spruce trees that are their prime habitat.

In the central and northern Peninsula, however, there are still a lot of medium-sized live trees (six to eight inch diameter) that are coming on line as good beetle fodder. Soldotna-area homeowners are frequently telling me that they lost several trees over the last year and that they are worried about their remaining trees.

At non-outbreak (normal) levels of beetles it is possible to take defensive measures. The best defense is a vigorously growing tree: this means thinning your stand and pruning the lower branches so that sunlight can warm the trunks for part of the day. Fertilizing the trees is good, and watering them during dry period (such as right now) is also helpful. It is also important

to get rid of slash and cover up freshly cut logs with plastic. The absolutely best beetle habitat is a fresh horizontal log. Indeed, you can use a freshly downed tree right now as a beetle magnet or trap tree, which must then be burned before the beetles emerge next spring.

Some homeowners spray their trees, which lasts for two to three years, but spraying involves a choice about introducing pesticides into your living space. After reading Theo Colburn's excellent book *Our Stolen Future* (Plume, 1997) about the impact of trace amounts of pesticides on embryo development in wildlife (and humans), I have become quite conservative about putting more chemicals into the environment. I didn't spray my trees in Homer in the 1990s and I ended up cutting most of them down—dozens of beautiful big Sitka spruce. This was a gut-wrenching experience, but in the grand scheme of things I feel that I did the right thing.

At the present low levels of beetle activity I think that homeowners can take effective preventative measures without spraying and still enjoy their spruce trees for many years. This being said, I suggest that homeowners plant some new trees every year, so that new stock will be coming of age as the older trees are phased out, for whatever reasons. In Homer the Kachemak Heritage Land Trust will have a tree sale the Eagle Quality Center this Saturday, May 24. For reforestation advice and assistance Al Peterson at State Forestry (262-4421) administers the Land Owner Assistance Program, which has matching funds available for replanting on a scale of several acres.

For some current beetle numbers on the Kenai, the Forest Service reports that "red needle" acreage fell from 27,051 acres in 2001 to 8076 acres in 2002. Almost half of the 2002 mortality (3579 acres) was in the mountains of Chugach National Forest. The surveyors observed 1424 acres on the south side of Kachemak Bay, and 3074 acres strung out from Homer to Point Possession, with much of it concentrated south of Skilak Lake (3055 acres). All of this is peanuts compared

to the peak years of the mid-1990s when Peninsula totals ran from 300,000 to almost 500,000 acres of fresh kill per year.

Around Refuge Headquarters in Soldotna we deployed three sets of beetle traps last week. For the second year, retired Forest Service entomologist Richard "Skeeter" Werner has provided the traps and will identify and count the beetles. The traps are baited with chemical attractants (pheromones). There are specific traps and pheromones for spruce bark beetles, Ips (engraver) beetles, and wood-boring beetles. Last year we caught a lot of Ips beetles, only a few spruce bark beetles, and a fair number of wood-boring ambrosia beetles. We collect the traps every two weeks throughout the summer.

I checked the traps after the first week and found only a few spruce bark beetles. I doubt that the main beetle flight has taken place, at least in Soldotna, but it could occur any day now. Each year I ask readers to give me a call (260-2812) if they see any spruce bark beetles flying, and I would ask this again this year.

David Henry and I have recently finished a report on our studies of spruce bark beetle outbreak history in the Kluane National Park area in the Yukon. The bark beetle history is very different in the Yukon, and the report compares the Kluane and Kenai Peninsula histories for the last 250-300 years. I also wrote a separate appendix on the role of climate in determining bark beetle activity in the two areas. The report can be read on the Refuge website under "Biology Program" at <http://kenai.fws.gov/>.

The USFS *Forest Health Condition Report 2002* is at www.fs.fed.us/r10/spf/fhp/fhpr10.htm. Hard copies can be ordered from Ed Holsten at eholsten@fs.fed.us, 907-743-9453.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. For more information about the Refuge, visit the headquarters in Soldotna, call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at <http://kenai.fws.gov>.