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As Trees Die, Some Cite the Climate

By TIMOTHY EGAN

SOLDOTNA, Alaska — Edward Berg has a pair of doctorates, one in philosophy and another in botany, but for the last decade he has been a forensic detective in the forest, trying to solve a large murder mystery.

The evidence surrounds him on his home in the Kenai Peninsula: nearly four million acres of white spruce trees, dead or dying from an infestation of beetles — the largest kill by insects of any forest in North America, federal officials say.

Beetles have been gnawing at spruce trees for thousands of years. Why, Dr. Berg wondered, has this infestation been so great? After matching climate records to the rate of dying trees, Dr. Berg, who works at the Kenai National Wildlife Refuge, believes he has come up with an answer.

He says a succession of warm years in Alaska has allowed spruce bark beetles to reproduce at twice their normal rate. Hungry for the sweet lining beneath the bark, the beetles have swarmed over the stands of spruce, overwhelming the trees' normal defense mechanisms.

If Dr. Berg is correct — and he has won many converts as well as some skeptics — then the dead spruce forest of Alaska may well be one of the world's most visible monuments to climate change. On the Kenai, nearly 95 percent of spruce trees have fallen to the beetle. Now, conditions are ripe for a large fire and could lead to bigger changes in the ecosystem, affecting moose, bear, salmon and other creatures that have made the peninsula, just a few hours' drive from Anchorage, a tourist mecca.

"The chief reason why the beetle outbreak has been the largest and the longest is that we have had an unprecedented run of warm summers," said Dr. Berg, a soft-spoken man in suspenders and running shoes, who is 62.

Temperatures in Alaska have risen sharply in the last 30 years, causing sea ice to break up off the northern coastlines, some glaciers to recede and permafrost to melt. But until Dr. Berg began matching rising temperatures to the number of trees killed by beetles, no one had tied the death of a forest nearly twice the size of Yellowstone National Park to warming temperatures.

Dr. Berg believes the larger culprit is global warming, brought on by increased emissions of greenhouse gases, which trap heat in the atmosphere.

But that is a bigger debate, one which Dr. Berg is normally not a part of. The implication of Dr. Berg's findings for other forests vulnerable to bugs is that as climate warms in the north, some species of evergreen trees that cover vast acreage could be mowed down by an ever-expanding population of beetles.

The dead spruce forest of Alaska is also a lesson, to some ecologists, of how warmer temperatures present intractable problems for living things anchored to a certain area. People can adapt, or even move, but trees that have been growing in one area for 8,000 years cannot — at least not quickly enough.

Other scientists who work on global warming issues are now looking at Dr. Berg's findings.

"His work is very convincing; I would even say unimpeachable," said Dr. Glenn Juday, a forest ecologist at the University of Alaska. "For the first time, I now think beetle infestation is related to climate change."

While Dr. Juday did not collaborate on Dr. Berg's spruce studies, he relayed some of the findings at a recent conference on climate change in Oslo, as part of the Arctic Climate Impact Assessment Project, a study by scientists from several nations. It was also presented by Dr. Berg himself in a speech at an American forestry conference this year.

"There is enormous excitement over Ed Berg's studies," Dr. Juday said.

But other scientists are still skeptical, saying it may be only a coincidence that rising temperatures go hand in hand with growing beetle infestations. Some say he has found a big piece of the puzzle, but not all of it.

"I think Ed Berg is only partially correct," said Dr. Ed Holsten, who studies insects for the Forest Service in Alaska. The trees on the Kenai are old, and ripe for beetle outbreaks. If they had been logged, or burned in fire, it might have kept the bugs down, Dr. Holsten said.

The spruce beetle, which is about a quarter-inch long with six legs, is barely visible to most people who roam through evergreen forests in the West and Alaska. Large swaths of forest in Colorado, Idaho and Wyoming have been felled by the bug. But nothing has approached the Alaska kill.

The beetles take to the air in spring, looking for trees to attack. When they find a vulnerable stand, they will signal to other beetles "a chemical message," Dr. Holsten says. They burrow under the bark, feeding on woody capillary tissue that the tree uses to transport nutrients.

In Dr. Berg's office, he has a cross-section of a tree that has been under attack by beetles. They build a web of canals as they eat. Eventually, the tree loses its ability to feed itself; it is essentially choked to death, a process that can take several years, Dr. Berg said.

Spruce trees produce chemicals, called terpenes, that are supposed to drive

beetles off. But when so many beetles go after a single tree, the beetles usually win. As it dies, the normally green needles of spruce will turn red, and then, in later years, silver or gray. Ghostly stands of dead, silver-colored spruce — looking like black and white photographs of a forest — can be seen throughout south-central Alaska, particularly on the Kenai. Scientists estimate that 38 million spruce trees have died in Alaska in the current outbreak.

"It's very hard to live among the dead spruce; it's been a real kick in the teeth," said Dr. Berg. "We all love this beautiful forest."

One reason Dr. Berg may have been able to see the larger implications of the beetle attack when others saw only dead trees is that he is one of few government scientists for the Fish and Wildlife Service who is paid to study the big picture.

His title is ecologist for the Kenai refuge. "When they hired me they felt the need to look at things from a broader scale rather than simply do moose counts," he said.

Working with a doctoral student, Chris Fastie, on a federal grant, Dr. Berg has been matching the volume of dead trees to climate. Since 1987, he said, the Kenai Peninsula has had a string of above-normal temperature years, particularly in the summer. Each of those years coincided with huge outbreaks of beetle infestation and dead trees, matching warmer years and a rise in spruce kills in the early 1970's. Dr. Berg found a similar pattern in the Kluane area of the Canada's Yukon Territory, where it is much colder.

Spruce beetle eggs normally hatch by August, then spend the winter, dormant, in larvae beneath the bark. They can withstand temperatures of up to 35 degrees below zero. The normal life of a spruce beetle — if not picked off by woodpeckers or other birds — is two years. But in the warmer years, Dr. Berg and others found that the beetles were completing a two-year cycle in a single year. This mass of insects has consumed nearly every mature spruce tree on the Kenai, until there is very little left to eat. Most of the trees are more than 100 years old.

Other scientists say the warming climate may be responsible for a big part of the huge bug outbreak, but not all of it.

"These bugs are coldblooded," Dr. Holsten said. "They are an early warning indicator of climate change. If it warms up enough they can complete that two-year life in a single year."

Spruce has grown on the Kenai Peninsula for about 8,000 years. Other infestations have killed up to 30 percent of a forested area, before bug populations died from fire or freeze or other natural causes. The current infestation never slowed until the beetles ran out of food.

"It slowed down only after they had literally eaten themselves out of house and home," Dr. Berg said.

The Forest Service has been studying beetle-killed spruce for some time, but has yet to come up with any way of attacking the insects, other than suggestions of logging and controlled-burn fires — each of which is hotly contested.

What may follow in the path of the dead forest will be likely be a mix of grasses, and more hardwood trees like birch, alder and aspens, said Dr. Berg.

Climate records have been kept for barely a hundred years in most places in Alaska. By studying tree rings — which expand in warmer years and barely grow in cold years — scientists in Alaska say the current warming period is unmatched for at least 400 years. By studying dead trees, they say they can find no evidence of a spruce beetle outbreak of this magnitude, ever.