

WEST TISBURY - Ever since a vast tract of Martha's Vineyard forest died two years ago, visitors who stumbled upon the graveyard of gray stalks have called it eerie, bizarre, and sad.

Now scientists are calling it something else: a possible climate change lesson.

The 500 acres of dead oak trees were the epicenter of an islandwide infestation of caterpillars that munched their way through millions of leaves for three consecutive springs ending in 2007. Then a severe summer drought hit the island, finishing off tens of thousands of the weakened trees.

"I have never seen anything like what has happened on Martha's Vineyard in New England," said David Foster, a Harvard University ecologist. "Usually you walk through forests and see some dead trees, but here, it's hundreds of acres and almost all of the trees in it are dead."

Ordinarily, such catastrophic damage would be chalked up to bad luck. But Foster, who is also director of Harvard Forest, the university's experimental forest in Petersham, and other researchers recently discovered a vast die-off of Cape Cod coastal oak trees 5,000 years ago during an abrupt warming period. They found evidence of the forest's demise in sediment samples from under lakes and ponds, and they speculate that the ancient - and far smaller contemporary - episodes may have roots in the same type of one-two climate punch: more-active bugs coupled with an intense drought.

Scientists predict that in a warming world, insects will thrive, and droughts and other extreme weather will become commonplace. With the prospect of more numerous bugs feasting on weakened trees, Foster wonders whether the recent die-off is a harbinger of more catastrophic ones in the future. While the dead trees will certainly be replaced by new ones, what species repopulate forests has ramifications for everything from lichen to leaf-peepers.

"These trees control the foundation of an ecosystem," said Foster, whose group has just been awarded \$100,000 from the National Science Foundation to study the Vineyard forest. "What happens when they collapse? We are trying to understand how everything in that forest copes."

Nobody foresaw the death of the oaks. In the spring of 2004, an intense caterpillar infestation gripped the trees for two weeks, raining thousands of inch-long green-and-gray caterpillars on the heads of islanders and visitors.

Many thought the bugs were the despised European winter moth that shows up in horror-movie-like numbers off the island, but scientists were able to confirm that most of the bugs were a native fall cankerworm. Not that the news was much better: Cankerworm moth numbers were legendary that winter when they emerged as adults, splattering car windshields so thoroughly that drivers could hardly see.

“The first year, it was a shock” that the leaves were disappearing so quickly, said Tim Boland, executive director of the Polly Hill Arboretum in West Tisbury, as he picked his way last week over lichen-covered dead oak branches that littered a narrow Arboretum path.

“Then it was, ‘They came. They went. Let’s hope they don’t come again.’ But they did . . . twice. And so did the drought,” he said, pointing to the lifeless trees around him that are part of the epicenter of the destruction. About 17 acres of the Arboretum’s trees were killed off.

The 2007 dry period began in July, with less than 2 inches of rain that month, according to the National Weather Service. Thousands of trees began dying across the island but for some reason, virtually all the trees in the 500-acre swath did. Boland suggests the forest’s location may be partly to blame - elevated and sandy, the ground may not have been able to hold enough water for the weakened trees. Foster isn’t sure that is the answer.

Across the island, communities are struggling to deal with dead trees that pose a safety hazard if they fall on roads or walking paths. In West Tisbury, executive secretary Jennifer Rand said, officials are going after only the “deadest of the dead” trees because there is not enough money to remove them all.

Polly Hill and private landowners in the dead-oak epicenter are not cutting the trees, a situation that is allowing Foster to understand how the forest recovers on its own.

The researchers have tantalizing clues to their climate theory. First, by examining long, cylindrical cores of sediment extracted from Cape Cod lakes and Vineyard ponds, they discovered that oak pollen dramatically declined about 5,000 years ago - at the same time as other sediment and vegetation records indicated warmer temperatures and drought conditions.

Second, scientists have known for years that New England’s vast hemlock populations also crashed 5,000 years ago, a situation initially attributed to insects because hemlock pests were found in a peat bog sample from that time.

But it would be unusual to have two enormous populations of trees crash at the same time, suggesting there was an underlying reason at play, such as climate. While just a pest outbreak or a drought may not have killed the trees, the combination - whether it was a drought followed by pests or vice-versa - could have wiped them out.

“Insects are always around with patchy disturbances, but you don’t see them wipe out entire species,” said Wyatt Oswald, assistant professor of science at Emerson College and a Harvard Forest research fellow who is studying the phenomenon.

There is another link to today. Just like 5,000 years ago, a pest is wiping out New England’s majestic hemlock trees. The nonnative woolly adelgid is mostly contained in southern New England because scientists believe it’s too cold for the insects to advance northward. But New England winters have warmed around 4 degrees

Fahrenheit in the last 40 years, and researchers believe the pest will make inroads into more northern regions as temperatures warm.

“It’s what makes the story interesting,” Oswald said. “The same two types of trees are dying at the same time” today, just as they did 5,000 years ago.

Today, the researchers are carefully watching what grows on the forest floor now that the sun is no longer blocked by oak leaves. Thorny catbriar and sassafras are filling in the gaps between the dead oak trunks. And beech trees are gaining a stronger foothold. Scientists say the pollen record shows the same thing happened 5,000 years ago, when the coastal oaks gave way to beech.

“Climate change will drive changes in the forest,” said Harvard’s Foster. “But they will be more rapid if the forest is also impacted by bugs.”

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