Deadly imports: In one U.S. forest, 25% of tree loss caused by foreign pests and disease

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Two Shenandoah National Park employees assess the crown of a black birch tree as part of the park's long-term forest monitoring program. NPS PHOTO/C. HARMAN

From a deadly fungus that showed its face in 1904 on an American chestnut in the Bronx to a nematode recently found to kill American beeches in Ohio, forests in the United States have faced more than 100 years' worth of attacks from introduced pests and pathogens. But how much of a chunk are these invaders actually taking out of the woods? A new study suggests the impact is severe, accounting for one-quarter of all tree deaths in eastern U.S. forests over the past 3 decades.

That death toll is likely far higher than the mortality caused by introduced species from the 1940s to the 1980s, and also "currently much bigger than any known effect of climate change," says Kristina Anderson-Teixeira, an ecologist at the Smithsonian Conservation Biology Institute who led the research.

Scientists have documented at least 450 foreign insects and pathogens that have found their way to North America and feed on trees. Most do little damage, but more than a dozen have proved extraordinarily destructive, wiping out tree species—or even whole genera—as functioning members of forest ecosystems.

Early tree plagues, such as a blight that wiped out mature American chestnuts in the first half of the 20th century, arrived before scientists were closely watching forests. But starting in the 1980s, researchers set up permanent monitoring plots to get a sharper view. In heavily forested Shenandoah National Park, they positioned 24-by-24-meter squares to capture different slopes, elevations, and forest types, says park botanist Wendy Cass. Since 1987, park scientists have surveyed these plots every 4 years. They have compiled more than 350,000 records of tree diameters, species, infestations, and deaths.

Examining data from 66 of those sites plus a nearby forest plot owned by the Smithsonian Institution, Anderson-Teixeira and colleagues found that eight types of tree—representing about one-quarter of the genera present in the park—had been hit by foreign pests. Collectively, oak, elm, ash, hemlock, butternut, dogwood, redbud, and chestnut trees died at a rate several times greater than that of unimpacted tree species. From 1991 to 2013, trees attacked by invasives accounted for about 25% of all tree death, measured by the amount of tree biomass lost, the scientists reported last month in Ecosystems.

That figure is about three times more than before the plots were installed, Anderson-Teixeira says, although she calls that estimate, which is based largely on a 1941 forest survey, "very rough." And the chestnut blight may have done damage comparable to today's death rate when it swept through in the early 1900s. According to some estimates, one in four trees in the Appalachians were once chestnuts.

It's not clear, however, how well the new results apply to other U.S. forests, and it's possible that unique factors—such as repeated outbreaks of a pest known as the gypsy moth—elevated the death rate of some species in the study area, says Andrew Liebhold, an entomologist with the U.S. Forest Service.

The study did turn up some good news. Trees from unaffected genera grew enough that, despite the losses, total forest biomass increased slightly over the study period, though likely less than it would have without the pests. Biodiversity in the study plots also held steady, as new species moved in to replace ones that were lost. "So far," Anderson-Teixeira says, "the forests are fairly resilient."

She cautions, however, that resilience may not hold up if new tree killers keep arriving. A nematode that eats American beech leaves, a lanternfly that feasts on dozens of plant species, and a relative of the hyperdestructive emerald ash borer have all popped up in the United States in the past decade. Advocates have urged state and federal agencies to impose tighter biosecurity measures, from bans on imports of potentially risky plants to stiffer penalties for shippers whose cargo is found to contain live pests. Earlier this year, a group of researchers called for the creation of a new federal division focused on forest pest control and prevention.

"Limiting the spread of invasives," Anderson-Teixeira and her co-authors write, "will yield benefits for biodiversity, climate change mitigation, and other ecosystem services."

*Correction, 12 May, 1:30 p.m.: This story has been edited to correct the name of the lead author, Kristina Anderson-Teixeira, and clarify the number of forest plots used in the study.

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