

# New research predicts which trees are at greatest risk of beetle invasion

April 16 2018

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Pitch pine forests are at greater risk of attack from the southern pine beetle than forests with a mix of tree species, according to research from Dartmouth College. The study shows that the composition of forests is more important than other factors when predicting where the destructive pest will strike next.

The research, published in *Forest Ecology and Management*, adds to understanding of the [southern pine beetle](#) and confirms previous research from the beetle's southern habitat on the importance of characteristics that increase forest susceptibility to the pest.

The research finding has important implications for forest managers who need to predict and prevent infestation by a pest that is already responsible for significant forest damage and that is continuing its climate-induced move northward.

"Knowing which tree stands may be most susceptible to this beetle is extremely important information for managers working to protect our forests," said Carissa Aoki, a post-doctoral research associate at Dartmouth and lead author of the study. "This research not only tells us that preventative treatment such as thinning can be effective, but also helps prioritize tree stands for treatment based on structural characteristics."

For the study, researchers focused on southern pine beetle infestations in the New Jersey Pinelands, a forested area that spans the southern and

central portions of the state. The coldest night of the winter in this region has warmed by about 7 degrees Fahrenheit in the past 50 years, creating favorable conditions for the southern pine beetle to increase its range.

"The northward movement of the southern pine beetle is just one example of how climate warming is permitting rapid range expansions," said Matthew Ayres, a professor of biological sciences at Dartmouth.

"We can expect many more cases because the warming continues. This might mean you can grow a cherry tree where you couldn't before, but you and your plants can also expect a growing battery of pests that weren't there before."

The team separated the study area into regions divided by the Mullica River and then further segmented [tree stands](#) as wet, lowland sites and dry, upland sites. To determine the importance of forest composition on beetle movements, researchers identified areas that are comprised of pitch pine and those that feature pitch pine and oak.

For the study, researchers determined the relative proportion of each forest type across the landscape. Then, through aerial detection and ground surveys, they determined whether forest types differed relative to where beetle activity was observed.

The researchers found that southern pine beetle infestations in both wetland and upland areas were far more likely to occur in pure conifer stands than mixed stands of oak and pine. While wetland conifer areas were especially affected, wetland mixed sites had fewer spots than expected.

While the study confirms some of what was previously known about the southern pine species, the finding in the Pinelands - that a high percentage of [pine trees](#) in a stand is a more important factor than moisture levels - is in contrast to previous research from the South that

indicated strong evidence for the connection between high moisture and stand susceptibility.

"The percentage of pine in a [forest](#) really matters. Our study shows that in forests with a range of pine and oak mixes, pine-dominated stands were at highest risk of infestation. From a management perspective, these stands can be prioritized for [preventative treatment](#) such as thinning," said Aoki.

Researchers also found that stands of intermediate age - about 25 to 75 years for pitch pine - were disproportionately infested. Forest stands comprised of older, larger trees tended not to be very susceptible, while young trees are known not to be susceptible and were not sampled. The volume of trees in a stand and the percentage of each tree that is green were also found to contribute to stand susceptibility.

The results indicate that the same tactics that have been effective at limiting beetle impacts in the South could also be effective in newly-occupied northern ranges. Those tactics include monitoring to detect population increases, rapid suppression of spots when they are still rare, and thinning of trees for prevention.

"It is good to know that the preventative techniques that have been used in the South will probably also be effective in the Northeast," said Aoki. "The research should also be heartening to managers who worry that thinning leaves old, large trees in place and thus may place these valuable trees at risk. Actually, such stands are demonstrably less susceptible than unmanaged stands."

Southern pine beetle activity occurs in extremes - either very rare or through infestations that involve millions of pests. During episodic outbreaks, the beetles readily kill even the healthiest pines through synchronized attacks that overwhelm tree defenses.

Within an outbreak area, such as now occurring in New Jersey, New York, and Mississippi, there can be as many as thousands of local epidemics - identified as "spots" from airplanes - within which hundreds of [trees](#) can die in a year.

"The southern pine beetle is one of the most aggressive tree-killing insects in the world. Outbreaks tend to be self-sustaining because the more beetles there are, the better they succeed," said Ayres, a co-author of the report with 25 years of experience studying the beetle species.

The last documented outbreak of southern pine beetle in New Jersey occurred over 80 years ago, but the mid-Atlantic states may see more regular outbreaks in the future. The northern New Jersey Pinelands, and pitch pine stands in the New England states with similar structural characteristics, are particularly at risk of infestation as the southern [pine](#) beetle continues to move northward.

As of 2014, a new outbreak was detected on New York's Long Island as well as scattered throughout Connecticut the following year. Beetles have additionally been trapped as far north as Rhode Island and Massachusetts, though large-scale tree mortality has not yet occurred in these latter states.

**More information:** Carissa F. Aoki et al, Old pests in new places: Effects of stand structure and forest type on susceptibility to a bark beetle on the edge of its native range, *Forest Ecology and Management* (2018). [DOI: 10.1016/j.foreco.2018.03.009](https://doi.org/10.1016/j.foreco.2018.03.009)

Provided by Dartmouth College

Citation: New research predicts which trees are at greatest risk of beetle invasion (2018, April

16) retrieved 22 June 2024 from <https://phys.org/news/2018-04-trees-greatest-beetle-invasion.html>

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