Scientists estimate invasive insects will kill 1.4 million US street trees by 2050

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A new study estimates that over the next 30 years, 1.4 million street trees will be killed by invasive insects, costing over 900 million dollars to replace. The findings are published in the British Ecological Society's

Journal of Applied Ecology.

Researchers from McGill University, the USDA Forest Service Southern Research Station and North Carolina State University have made the first nationwide spatial forecast of street tree mortality from invasive insects, using data from roughly 30,000 urban areas across the United States.

90% of the 1.4 million trees deaths forecasted in the study are predicted to be caused by the emerald ash borer (*Agrilus planipennis*), which is expected to kill virtually all ash trees in more than 6000 urban areas.

The researchers predict that the impact of invasive insects will not be evenly spread across the country, with less than a quarter of US communities set to experience 95% of all street tree mortality resulting from invasive insects.

Hotspots identified in the study include New York, Chicago and Milwaukee. These are areas with very high numbers of ash trees and are in the recent or near-future path of the emerald ash borer. Large human populations are also predicted to increase the influx of invasive insects to an area.

The researchers also forecasted the risks of insect species that have not yet arrived in the US. Asian wood boring insects, like the citrus longhorned beetle (*Anoplophora chinensis*), were seen to pose the highest threat, with new establishments of these species potentially costing 4.9 billion dollars over the next 30 years.

The researchers say that their findings can also help urban tree managers to know which tree species, in which areas, will be at the greatest risk from invasive insects. This information can be used to prioritize management efforts such as quarantining wood products.

Dr. Emma Hudgins at McGill University and lead author of the research said: "These results can hopefully provide a cautionary tale against planting a single species of tree throughout entire cities, as has been done with ash trees in North America. Increasing urban tree diversity provides resilience against pest infestations. While we know this more intuitively for monocultures of crops, many cities continue to plant what are essentially monoculture urban forests."

Professor Jane Memmott at the University of Bristol, who was not involved in the study said: "Urban trees do a variety of wonderful things—they keep cities cool, they take the sting out of heavy downpours, they are good for biodiversity and they even make people happier.

"This paper shows that unless we plant a variety of tree species in our cities, urban trees are seriously at risk from invasive pests. The take home message to urban planners, is to plant multiple species in cities rather than focus on just a few familiar species; It'll keep trees wonderful, and it will keep them in our cities."

While the findings of this study specifically relate to the US, the same invasive insect species can impact urban trees in neighboring countries.

Dr. Hudgins said: "We can see a similar situation in Canada, since emerald ash borer arrived here by spreading across the border with the United States, and cities like Montréal are in the process of losing all of their ash trees. Colder cities like Winnipeg appear to be seeing delayed impacts of emerald ash borer due to its need to complete a longer life cycle at low temperatures."

Trees form an important part of our urban environments and provide a host of benefits including improving air quality, cooling streets, carbon capture, habitat provision for wildlife and improving citizens' mental and

physical health.

However, human activity such as trade and travel expose urban trees to higher numbers of invasive species. Urban environments also create conditions that allow invasive species to easily spread.

Dr. Koch explains: "Many urban areas are dominated by a single tree species or genus, which means that a newly arrived insect for which those trees are a host can spread easily. On top of this, there are usually fewer natural predators and warmer temperatures compared to nearby natural forests, which can benefit invasive insect development."

To forecast the impacts of invasive insects on US street trees over the next 30 years, the researchers combined a series of four models. These included models of street tree populations in 30,000 communities, the predicted spread of 57 invasive insect species, how deadly these insects are to different tree species, and the cost of removing and replacing dead trees.

Due to the availability of accurate data, the study focussed specifically on street trees, which represent a small fraction of all urban trees. The study also only forecasted the economic costs to municipalities dealing with street trees being killed and not wider the ecological impacts. Dr. Koch said: "The ecological impacts of losing urban trees or an invasive species moving from urban to natural forests would both be considerable. However, these impacts were beyond the scope of our study."

More information: Emma J. Hudgins et al, Hotspots of pest-induced US urban tree death, 2020–2050, *Journal of Applied Ecology* (2022). DOI: 10.1111/1365-2664.14141

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