

Emerald Ash Borer Invasion of North American Forests

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EAB larva



Adult EAB

Photo credit: David Cappaert

The emerald ash borer (EAB) is an invasive insect that was accidentally introduced from Asia into North America during the early 1990s, although not discovered until 2002. Since establishing near Detroit, Michigan, EAB has killed millions of ash trees including more than 99% of the ash trees growing in the forests of southeast Michigan.

Adult EAB feed on the leaves of ash trees and cause little damage; however, the beetle's larvae feed on the inner bark and create galleries that cut off the ash tree's circulatory system. This can kill the tree within just a few years.

As of May 2010, EAB has been detected in 13 states and two Canadian provinces, and it continues to spread each year. Ash trees are an integral part of many different ecosystems, and the disappearance of these trees will have dramatic effects on forest communities. The Ohio State University, Michigan State University, and the USDA Forest Service have been collaborating on an investigation of the ecological impacts of the widespread ash mortality caused by EAB.

Impacts on Native Animals

Widespread ash mortality severely alters forest habitats. Such a disturbance can negatively affect native animals. For instance, scientists have observed a reduction in ground beetle populations in areas heavily impacted by EAB. At least 282 arthropods (insects and spiders) rely on North American ash trees as a source of food and shelter. As EAB continues to kill ash trees, many species including butterflies, beetles, moths, flies, and true bugs are becoming at risk of extinction. In particular, at least 44 species of arthropods that feed exclusively on ash trees will be severely impacted. As all ash trees are killed, these animals will be at risk of extinction as their food and shelter are eliminated. However, animals such as woodpeckers and cavity-nesting birds that use dead trees as a resource for food and shelter may temporarily increase.

Native butterfly populations may also be affected, as some plants on which caterpillars feed become more toxic when grown in sun rather than in shade. Therefore, canopy gaps created by dying ash trees may increase the toxicity of native plants, thereby negatively affecting insects that feed on them. Scientists at The Ohio State University are currently studying the effects of canopy gaps on giant swallowtail butterfly development and growth.

Photo credit: T. Beth Kinsey



Canopy gaps created by EAB may affect the growth and survival of giant swallowtail butterfly caterpillars.



The banded ash clearwing borer is at risk of extinction due to widespread death of ash trees caused by EAB.

Impacts on Native Plants

Scientists studying the effects of EAB on ash regeneration and forest succession have collected soil samples from southeast Michigan EAB-impacted forests for several years and have found no viable ash seeds and no new germinating ash seedlings. Their findings suggest that these areas lack an ash seed bank in the soil and that ash trees may not return after an EAB invasion affecting the composition of future forests.

Research also suggests that increased light in the forest floor, resulting from canopy gaps created by dying ash trees, may facilitate the establishment and spread of invasive plants. Exotic species such as oriental bittersweet, honeysuckle, multiflora rose, and autumn olive flourish in disturbed sites with higher light such as those created when EAB kills ash trees. Invasive plants may out-compete native plants in these environments, which could alter the long-term succession of the forest.



Canopy gaps caused by EAB increase the light that reaches understory plants.



Honeysuckle, an invasive shrub, dominates the understory of a forest impacted by EAB.

Ecological Impacts

Ash trees are found in a diverse range of ecosystems, from dry, upland forests to swamps. They provide food and shelter for numerous insects, birds, and mammals as well as play a role in nutrient and water cycling. Researchers have found that all forests are susceptible to invasion by EAB regardless of their composition, structure, and density of ash trees.

Widespread ash mortality results in a sudden increase of large amounts of standing and fallen dead trees in the forest. This can alter soil pH, mineral concentration, and soil moisture levels. Since the chemistry of the soil plays an important role in decomposition and water cycling, ash mortality can affect the nutrient resource availability for remaining trees. As large canopy trees die, the amount of light reaching the forest floor increases dramatically, which has profound impacts on the understory environment. These impacts, in turn, substantially affect plant and animal habitats and other ecosystem services.



Ash mortality increases the amount of dead wood on a forest floor.

For more information visit www.emeraldashborer.info.

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