

Invasive Species Alter Habitat to Their Benefit

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When scientists study habitats that alien species have invaded, they usually find predictable patterns. The diversity of native species declines, and changes occur in natural processes such as nutrient cycling, wildfire frequency and the movement of water through the system.

But simply observing such changes doesn't prove that the invaders are responsible.

University of Michigan researchers Emily Farrer and Deborah Goldberg, however, came up with a way to tease out the cause of environmental changes in northern Michigan wetlands where invasive cattails have taken hold. The cattails, they found, alter the environment in ways that hinder native species but benefit the invaders. Farrer and Goldberg will present their results Aug. 9 at a meeting of the Ecological Society of America in Memphis, Tenn.

"When you have an invasion, you typically see three things happening at once: the invasion, the change in environment and the decrease in diversity," said Farrer, a graduate student in Goldberg's laboratory group. "But they're all happening concurrently, so you can't really tell which is causing the other." Other factors may enter in. For example, human activity, such as the use of fertilizers and road salt and the suppression of natural wildfires, also may result in environmental changes that affect species diversity.

"My question was, are humans causing the changes, or are the invaders?"

Farrer said. "Finding the answer has practical implications: if you're trying to restore a natural habitat, you have to know the cause of the decline in native species. Do you target the invader or try to minimize human interference?"

Farrer began by surveying marshes in northern Michigan to find out what kinds of cattails were there. The state is home to three cattail species: the native broad-leaf cattail; the invasive narrow-leaf cattail, which was introduced on the east coast in the early 19th century and eventually found its way inland; and a hybrid of the two species that is larger than either parent and tolerates a wider range of environmental conditions.

In the marshes she studied, Farrer found that hybrids were more common than native cattails. She also noted that the areas of each marsh with lots of hybrid cattails had higher nutrient levels and heavier mats of dead cattail stems than areas with only native wetland plants. The plants growing in these invaded areas also were different, with fewer classic wetland species, such as bulrushes, rushes, and sedges, and more typical land plants like grasses, asters, and goldenrods.

Next, Farrer did transplant experiments to figure out whether the invaders were causing the changes she observed. She set up four study plots in a previously uninvaded section of marsh. In one, she transplanted live hybrid cattails; in the second she added litter---the mats of dead stems that accumulate around hybrids. A third plot received both live hybrids and litter, and the fourth was left alone.

Litter accumulation was the deciding factor, she found. "Plots with the litter treatment had higher levels of nitrogen in the soil and higher turnover rates of nitrogen, along with much lower light levels and lower soil temperatures," Farrer said. "So the litter was creating a pretty different environment."

When she tallied other plants in the experimental plots, she found that both the diversity and the density of native species were lower when litter was present. But while native plants suffered, invaders prospered. "The hybrid plants performed better with litter addition," Farrer said. "They obviously aren't hindered by the litter, and the increase in nutrients may help them grow larger."

The results suggest that invasive cattails set in motion a feedback loop that helps them gain a stronghold. "The invasive cattails change the ecosystem through litter accumulation, producing an environment in which native plants don't perform well but the invaders do," said Farrer. "As the environment changes, the cattails get more abundant and change the environment even more, resulting in even more cattails. It's interesting---and sobering---to think that it's not just humans that go out and mess up the habitat; invasive species can actually initiate that cycle."

Source: University of Michigan

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