

Powerhouse plants that bolster the food web

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A white-blotched *Heterocampa* munches on an oak leaf. A new study led by the University of Delaware's Doug Tallamy identifies the most critical plants needed to sustain food webs across the United States. Credit: University of Delaware

University of Delaware Professor of Entomology Doug Tallamy

published a new research study in *Nature* that systematically identifies the most critical plants needed to sustain food webs across the United States. Alongside co-authors Kimberley Shropshire and former graduate student Desiree Narango, now a postdoctoral researcher at the University of Massachusetts Amherst, the study drills down to the top plants in each county and bioregion, illuminating a plan for how to restore ecosystems anywhere in the country.

Why care about [food webs](#)? Well, these complex, highly interconnected systems of feeding relationships are essential for our planet's health. The Earth and its many species depend on them, including humans.

To get the feast started, who has the first seat at the dining room table? The system all starts with [plants](#), which get great publicity for their ability to convert carbon dioxide and into breathable air. But plants also have another, lesser known talent; they capture energy from the sun and turn it into food. Animals eat plants. Some eat plants directly; others obtain this energy by eating an animal who eats plants. And what animals are the best at converting this energy? Think small.

Punching way above their weight class, insects are the best creatures on Earth at this energy transfer. And the world champions are caterpillars of the Lepidoptera species, the lifeblood of the food web whose protein-rich bodies are ideal for hungry birds.

But caterpillars and other insects can't simply thrive among any plants; they must be surrounded by native plants, meaning those that have evolved alongside insects over millions of years. For example, caterpillars in Delaware like the promethea silkmoth don't jive with popular exotic trees like crepe myrtle, a popular choice by homeowners.

And not just any native plant will do. The new research finds that only a few powerhouse plants support the majority of Lepidoptera. Ninety

percent of what caterpillars eat is created by only 14 percent of [native plant species](#) with only five percent of the powerhouse plants taking credit for 75 percent of food. This pattern is consistent wherever you go in the U.S.

"Most people talk about a food chain as if it's linear. In a diagram, these connections look like a web rather than a simple chain," said Tallamy, a conservationist and bestselling author. "Take a keystone [native plant](#) like an oak tree. More than 500 types of caterpillars can eat that oak tree. That allows for a more complex and, thus, more stable food web."

It's known that native plants are much better for an ecosystem than non-native plants, but this new study takes the knowledge an important further step.

"There are certain native plants, and there are actually not that many of them, that are doing the bulk of the work," said Tallamy. "So, if you build landscapes without these powerhouse plants that support caterpillars, the food web is doomed."

The mid-Atlantic region boasts more than 2,000 plant genera; Tallamy and Narango categorized 38 as powerhouses. Native oaks, willows, birches and wild cherry trees made the trees' list; the most powerful herbaceous plants included goldenrod, asters and perennial sunflowers.

Tallamy, a veteran of conservation research, was surprised by just how significant the difference was between powerhouse plants and other native species.

"The magnitude of the differences surprised us. It's not just a steady continuum where you have all of your native plants lined up and, from one plant to the next, there's a gradual decrease in productivity," said Tallamy. "It is extremely skewed toward these powerhouse plants."

The Lepidoptera order of insects includes butterflies and moths. While butterflies are more admired for their beauty, the tastier moth caterpillars do most of the work of transferring energy to predators.

"You hear a lot about butterfly gardens. We need to think more about Lepidoptera gardens that include moths, who are the biggest driver of the food web," said Tallamy.

Today, because of human expansion, pesticides and species isolation, insect populations around the world are in a precipitous decline, referred to as Insect Armageddon. Flying insects like moths have seen a 78% reduction over the past 40 years. Whether you love insects or run in fear of these six-legged invertebrates, their demise will affect you.

"Insects pollinate 90% of our flowering plants. Without insects, we'd lose these plants, which collapses the food web," said Tallamy. "We'd lose amphibians, reptiles, birds, mammals and even some freshwater fish."

On top of their energy transfer abilities, insects are also crucial to soil decomposition, unlocking dead plant and animal material and returning nutrients to the soil. Sure, fungi and bacteria also have this talent, but they are significantly slower than insects. Tallamy puts it bluntly.

"If insect populations continue to decline, the Earth will rot. Humans will not survive such a drastic change," said Tallamy. "Insects are essential not just to our well-being, but to our continued existence on Earth."

So, what can you do to help? As Tallamy details in his New York Times bestseller *Nature's Best Hope: A New Approach to Conservation that Starts in Your Yard*, homeowners can turn their yards into conservation corridors that provide wildlife habitats. They just need to choose plants native to their region.

"We need to change the cultural norms of what our yards should look like. Homeowners can shrink the size of their lawns," said Tallamy. "But you can't simply replace the grass with any old plants; choose key native plants that support local insect populations. If you're in the mid-Atlantic, pick from the 38 genera that we identified. Start with oaks. Some others on the list aren't the most beautiful, but we need to learn to accept that. Maybe you plant a black cherry in the backyard instead of out front."

The same goes for public and non-profit efforts to restore ecosystems. Without powerhouse plants, restoration efforts will fall short.

"Think of a baseball team. What if you constructed a lineup of only pitchers and zero position players? They all pitch, but are lousy hitters, so you're going to lose the game," said Tallamy. "Take these national and international ventures [focused on forest restoration]. It's important to plant trees, but we need to have the right lineup of powerhouse plants native to each region."

More information: Desiree L. Narango et al, Few keystone plant genera support the majority of Lepidoptera species, *Nature Communications* (2020). [DOI: 10.1038/s41467-020-19565-4](https://doi.org/10.1038/s41467-020-19565-4)

Provided by University of Delaware

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