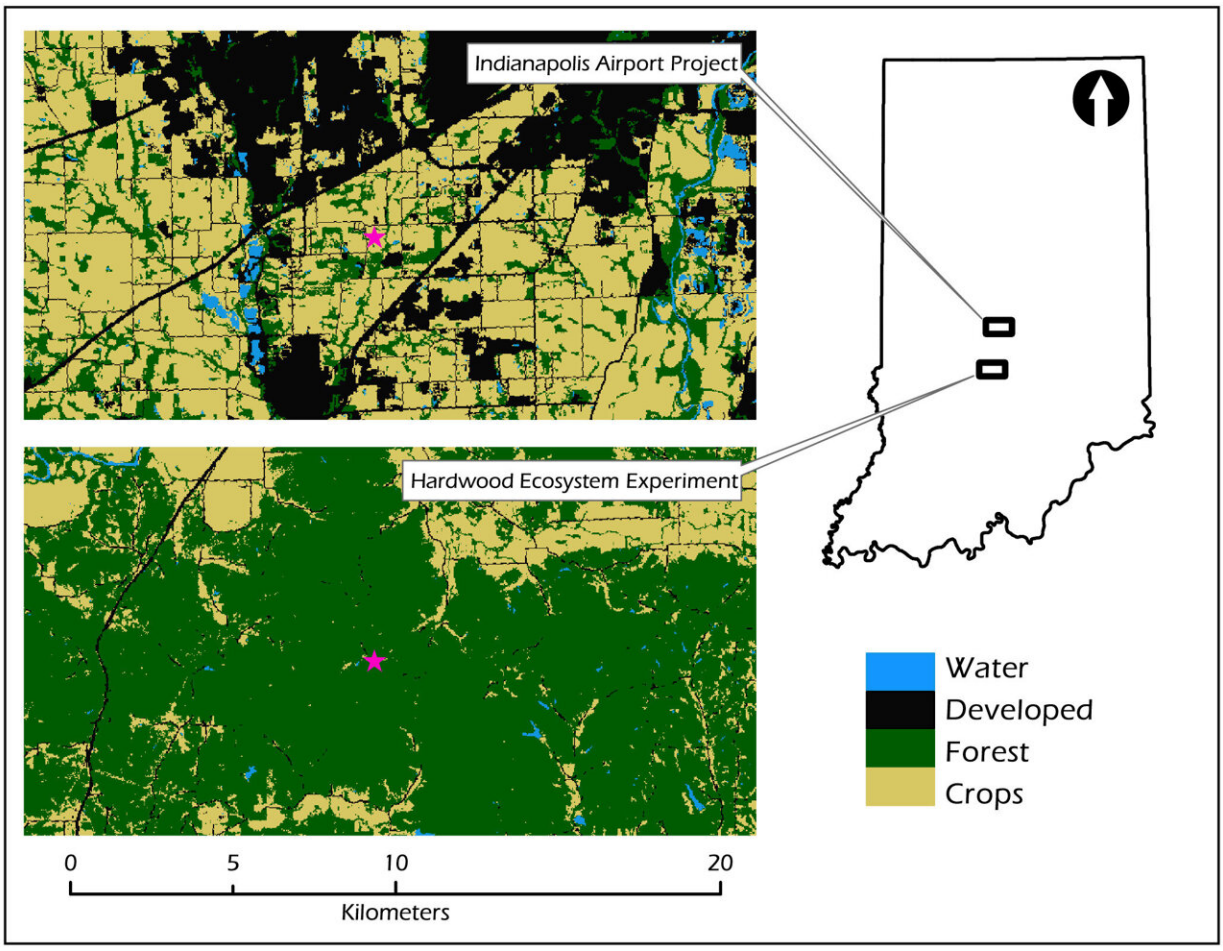
Bats' midnight snacks reveal clues for managing endangered species

September 13 2022, by Lauren Quinn



Sample collection sites in south-central Indiana, situated 50 km apart. The Indianapolis Airport Project (IAP) consists of riparian forest patches surrounded by agriculture, residential, and commercial development (~5400 ha sampling area). The Hardwood Ecosystem Experiment (HEE) is a contiguous forest with active timber management (~19,000 ha sampling area). The center of each study

area is marked with a pink star. Credit: Timothy J. Divoll et al, *Environmental DNA* (2022). DOI: 10.1002/edn3.354

How do we bring threatened and endangered animals back from the brink? The task is never easy or simple, but one thing is undeniably true: If we don't understand these animals and what they need to survive, we have little chance of success.

Saving bats, then, is arguably a trickier endeavor than for other species. After all, the cryptic critters only emerge at night and are highly mobile, making it difficult to track their movements and behavior.

In a first-of-its-kind study, University of Illinois and Brown University scientists reveal the diets of endangered Indiana bats and threatened northern long-eared bats, providing clues to effectively manage both species and their habitats. The study, is published in *Environmental DNA*.

"This was an in-depth study of these two imperiled species in landscapes where they co-occur. Nobody's done that before. This investigation gives us a much better sense of how bats not only coexist, but also how they benefit our forests and how we can thus manage the forest to provide bats with better habitat," says Joy O'Keefe, an assistant professor and wildlife extension specialist in the Department of Natural Resources and Environmental Sciences at Illinois.

Previous research into these bats' diets relied on older, outdated technologies that could miss important prey species. And no study had yet investigated how the two species divvy up their prey resources to coexist.

"When you have two closely related species sharing the same habitat, that means they're probably built similarly and need similar places to live and things to eat. This brings up a lot of questions about how they're doing that. Are they competing? Or is there some system in place where they're able to divide resources? Our job was to figure that out," says Tim Divoll, a data scientist in the Center for Computation & Visualization at Brown who completed his doctoral research with O'Keefe.

Divoll and O'Keefe humanely captured bats and collected fecal samples at two Indiana locations—a large managed forest and an area with small forest patches near a major airport—over four summers. The researchers identified insect prey from DNA in the bat feces and added a size classification as a more practical way of looking at insect prey.

"If a bat sees two moths that are the same size and have the same flight pattern, the bat's not going to distinguish what species they are. It's going to eat whatever moth it can catch," Divoll says. "I wanted to use an analysis that better aligned with how bats might perceive their prey. We tend to assume that genetic classifications of prey are the most meaningful, but bats don't study taxonomy.

"But the taxonomic identification can be very interesting. For example, maybe there are some insects in the dataset that require specific host plants. We want to help managers recognize that so they can manage for a diversity of plant types that host a diversity of insects, leading to healthier forests and more food options for bats."

Overall, the two bat species ate a lot of the same insects, including moths, beetles, crickets, wasps, mosquitoes, and more. They also ate a significant number of agricultural and forest pest species, displaying their role as providers of beneficial ecosystem services.

Somewhat surprisingly, the northern long-eared bats, the smaller of the two, picked up slightly larger prey items. According to the researchers, that's likely because the northern is a gleaner, meaning it grabs prey off surfaces, at least some of the time. O'Keefe says bats that use a gleaning strategy would likely have an easier time locating larger insects on bark or leaves. That's in contrast to aerial hawkers, bats that take prey mid-flight; they'll detect and go after anything moving in the air, whether it's large or small.

That slight difference in prey size preference and feeding style may be enough for the bats to avoid direct competition, but the researchers can't be sure from this study alone.

"It's difficult to say whether they're in direct competition without measuring the availability of different insect types, and we didn't measure that in our study. But our earlier research in the same forested site showed northern long-eared bats use much less space when foraging than Indiana bats. And they're selecting habitat slightly differently. At the end of the night, they might end up eating all the same things, but they're finding them differently," Divoll says.

The bats' diets were so similar that there were greater differences between sites—forest or airport—than between bat species.

"This tells us that at some level, they are generalizing on whatever is available at a given site. They might be flexible and specialize at certain times, but these two bats are going to go after whatever is predominantly there," Divoll says. "They may use different hunting techniques and search different heights of the forest, but they both likely capture easy targets while searching for preferred prey."

Study authors include Tim Divoll, Veronica Brown, Gary McCracken, and Joy O'Keefe.

More information: Timothy J. Divoll et al, Prey size is more representative than prey taxa when measuring dietary overlap in sympatric forest bats, *Environmental DNA* (2022). DOI: 10.1002/edn3.354

Provided by University of Illinois at Urbana-Champaign