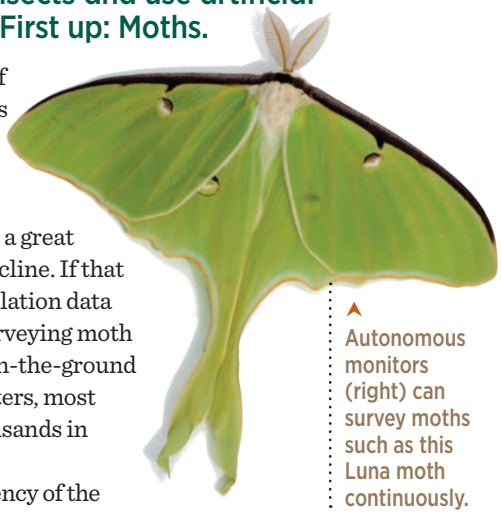
Using AI in the Race to Save Insects

To protect insects against decline and collapse, we need a more robust accounting of their populations and population trends. VCE is working with international partners on a revolutionary new way to speed up that process—autonomous, computer-controlled monitoring stations that attract insects and use artificial intelligence (AI) to identify them. First up: Moths.

Moths are an incredibly diverse group of insects that are important to the ecosystems they inhabit. They are a valuable food source for everything from spiders to bears, and are vital and prolific pollinators, too.



Autonomous monitors (right) can survey moths such as this Luna moth continuously.

Scientists are concerned that moths, like a great many other insect groups, may be in rapid decline. If that sounds indecisive, it's because baseline population data for moths is spotty at best. Why? Because surveying moth populations across large areas using boots-on-the-ground field techniques is very challenging. For starters, most of the astronomical number of species—thousands in Vermont alone—are nocturnal.

To tackle the knowledge gap with the urgency of the moment, VCE's Kent McFarland and a team of biologists, engineers, and computer scientists from around the world have designed and built autonomous, computer-controlled monitoring stations—stationary robots, basically—that can survey moths continuously, in any environment, and orders of magnitude faster than human researchers ever could.

In 2022, the team successfully field-tested the units in the United Kingdom, Canada, Cyprus, Panama, Argentina, and of course here in Vermont.

At sunset each night, the units automatically turn on using a solar-powered battery. The computer triggers the camera to snap an image each time a moth lands or moves on the moth-attracting UV light panel. Each image is then analyzed by AI, first to determine if it is a moth, then—if it is—to classify it.

Building reliable AI for identifying moths in this way requires feeding the software lots of information from which it can "learn" to distinguish one species from another. Due almost entirely to VCE's mobilization of community scientists to document moth sightings over the last decade, we were in a unique position to provide that information. Those records—well over a hundred thousand of them, logged through VCE projects on iNaturalist, and available via the VAL—are the knowledge base on which this powerful new technology is being built.

Ultimately, these units will be feeding vast amounts of data back into VAL. And while the first-generation machines are focused on moths, efforts are already underway to expand monitoring capabilities to other taxa as well. The potential torrent of new data could revolutionize our ability to detect insect population changes and create effective conservation plans.

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FUN FACT

The scientist charged with building the AI for this project is Dr. David Rolnick, professor at McGill University. David is a pioneer in machine learning applications for climate change and biodiversity, but we first got to know him as a budding, 12-year-old naturalist who volunteered to help us with the first Vermont Butterfly Atlas in the early 2000s. It was clear at the time that David was destined for great things, and it's an honor to be working with him again.

Communicating Science

Biologist Jason Hill connects experts with community members to discuss topics such as insect conservation in a warming world.

➤ ***Suds & Science:*** VCE biologist Jason Hill hosts this live and laid-back free program, in which guest scientists talk about their work and engage in Q&A with the audience. Explore the video archive and learn about upcoming programs at vtecostudies.org/suds-and-science.

➤ ***eNews:*** Every month, VCE's electronic newsletter, eNews, brings the outdoors to your email inbox. We report on the innovative field work of VCE biologists and breaking news from the frontiers of conservation biology—here in Vermont and beyond. *eNews* is short and designed to inspire you to explore the natural world. Subscribe at vtecostudies.org/subscribe or find past issues at vtecostudies.org/enews.

➤ ***Field Notes:*** Our annual spring and autumn news magazine offers in-depth explanations of the science and conservation efforts of VCE biologists and our community scientists. Learn about what we've been doing and how you can join us to study and conserve wildlife. Find past issues online at vtecostudies.org/field-notes.