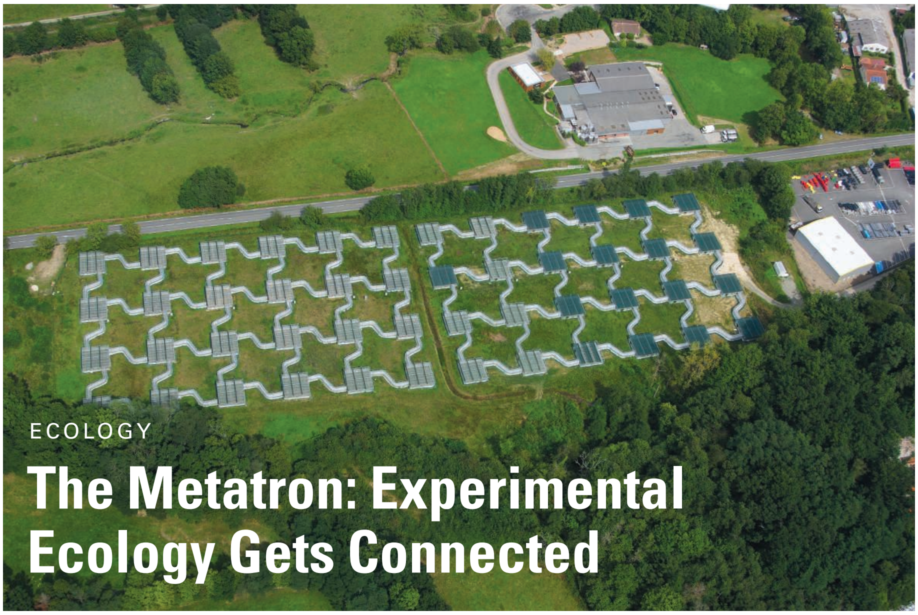

ECOLOGY

The Metatron: Experimental Ecology Gets Connected

A-maze-ing. Metatron tents can be darkened and cooled by shutters to study animal dispersal.

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Nestled in the foothills of the Pyrenees in France, an unusual new ecological laboratory called the Metatron is set to provide insights into how animals disperse across landscapes—a sometimes mysterious process that can be crucial to conservation. Composed of dozens of large, interconnected white tents laid out across a 4-hectare field, the sensor-rich facility will enable researchers to explore how factors such as light, temperature, and rainfall influence animal movements. "There's really nothing else like it," says ecologist Joshua Tewksbury of the University of Washington, Seattle. But he and others caution that the Metatron won't be appropriate for studying all kinds of animals and that it isn't an exact replica of the natural world. Still, initial studies published this week suggest that the facility, which celebrated its official ribbon-cutting earlier this month, can mimic natural conditions for some small creatures—such as lizards and butterflies—that can be hard to track in the wild.

The Metatron is the brainchild of Jean Clobert, director of research for the Experimental Ecology Station of the French national research agency (CNRS) in Moulis, France. Clobert has studied the dispersal ecology of lizards for years, and he conducted some small-scale experiments that allowed the reptiles to move through cages and corridors. But he was frustrated by the inability to control the environmental conditions that can influence movement, or to better replicate natural communities by introducing other types of animals to his system. Adding this kind of complexity would have required "a big jump," he says.

In 2007, Clobert took that leap, raising €1.6 million for the Metatron from the European Union, the French government, and other sources. Clobert's team chose the name to reflect the Metatron's focus on metapopulations and metacommunities: groups of organisms living in different places that interact in various ways. The name is also a nod to the 20-year-old Ecotron, a pioneering indoor laboratory facility at Imperial College London, Silwood Park.

The Metatron offers researchers a lot of flexibility and control. Its 48 insect- and rodent-proof tents enable them to create many replicates, increasing the statistical power of experiments. Each tent covers 100 square meters of grass—a sizable amount of habitat for smaller animals. Motorized roofs allow scientists to vary the amount of light, while sprinklers control precipitation and influence humidity. What's most novel are the corridors. Tents have up to four doors leading into passageways to adjacent tents, each of which can have different environmental conditions. The doors can be closed at the top or bottom to give flying or walking animals choices for where they would like to go next.

Clobert and his colleagues started two pilot experiments in August 2010, when the facility was half-finished. They released 339 common Eurasian lizards (*Zootoca vivipara*) and tracked them for 10 months. Many of the lizards spread among the chambers and reproduced at natural rates, the team reports online this week in *Nature Methods*. Another project showed that large white butterflies (*Pieris brassicae*) appeared to behave normally in the Metatron. "What they've done is show that it works" with two very different types of organisms, says Marc Cadotte of the University of Toronto, Scarborough.

The big question is exactly how realistic the Metatron can be. For example, the butterflies used in the pilot experiment may be too mobile to gain robust ecological insights, says Nick Haddad of North Carolina State University in Raleigh; they can fly greater distances than the entire Metatron, he points out. And although the setup is "very impressive," says Ran Nathan of the Hebrew University of Jerusalem, its corridors are not as interconnected as in nature. Life in captivity may also skew results. To sort out which behaviors and patterns might be a byproduct of the Metatron, researchers will need to conduct control studies of the same species in natural settings, predicts Martin Wikelski of the University of Konstanz in Germany.

Clobert agrees, and he has a head start from studying natural populations of Eurasian lizards for 24 years in the Massif Central. Now, he's using the Metatron to examine the impact of higher temperatures on lizard dispersal, as well as how they prey on insects in fragmented landscapes. Other researchers have started a menagerie of experiments with bumblebees, damselflies, and amphibians, hoping to discover, for example, whether butterflies move to new habitats to avoid inbreeding and how climate warming affects simple food webs. The facility will consider other proposals, which a small committee evaluates for merit and ability to contribute to operating expenses.

Ultimately, the Metatron could yield basic insights in ecology. "Its primary payoff to the scientific community will be by testing fundamental principles and theoretical predictions," Cadotte says. And although such basic work may not immediately contribute to conservation, Haddad imagines diverse applications: The Metatron could be used to test whether conservation corridors can unintentionally spread invasive species, for instance, or whether genetically modified organisms, such as mosquitoes or crops, alter ecosystems.

In the meantime, Clobert and his team plan to enhance the Metatron by adding an animal tracking system and connections among corridors to make them more realistic. They've also submitted a proposal to build equivalent systems for streams and ponds.

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