Ecologists gather the pieces of a first-principles-derived ecological theory

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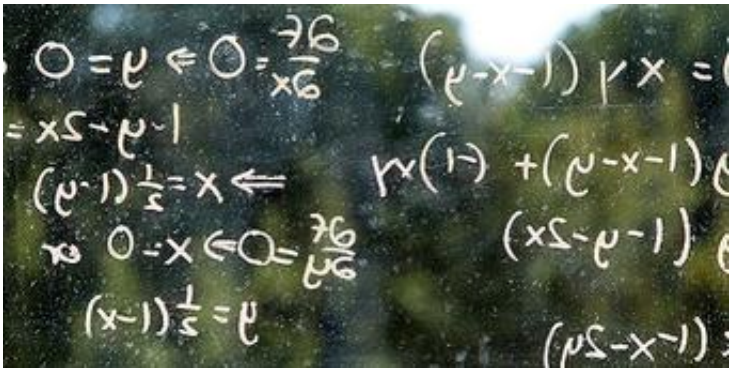

Credit: Santa Fe Institute

Writing in the pages of *BioScience* two years ago, SFI External Professor Pablo Marquet, SFI Professor and VP for Science Jennifer Dunne, and a team of ecologists – many of them SFI scientists – made a bold call: It's time, they argued, for a new synthesis of ecological theory based on something they termed "efficient theory."

This week, the scientists meet at SFI to take some of the first concrete steps toward the sort of theories they outlined.

"We already have our manifesto on what are the salient characteristics of the theories we will focus on," Marquet says. "Now, the exercise would be to trace the point of connection between these theories and see how they can be integrated."

The workshop is the second formal meeting of the Network for Ecological Theory Integration (NETI), as the group is now called. NETI traces its origins to a 2006 meeting that brought together leading theorists in metabolic scaling, ecological networks, neutral theory, and other fields of ecology that had been developing largely independently.

Out of that meeting and several more that followed, the people that would form NETI developed the idea of efficient theory – theory that is "grounded in first principles, expressed in mathematical language, simple, and makes a large number of predictions relative to the number of free parameters it contains," Marquet says.

Now NETI's aim is to start putting seemingly disparate theories together to create a more unified understanding of ecology. "There is a sort of algebra for theory integration that we want to develop," Marquet says. That could mean using the predictions of one theory as the inputs for another theory. For example, predictions derived from metabolic theory could be used as constraints in maximum entropy theory, which makes predictions about biodiversity patterns based in part on the metabolic energy available in a region.

"But also it is important to look at cases where different theories make similar predictions starting from different assumptions," Marquet says, or where similar theories with slightly different assumptions reach quite different predictions.

The workshop's organizers do not expect to create a complete, unified theory of ecology in just one week, Marquet says. Rather, "we're in the process of just showing the connections between different theories, and showing you can do this with efficient theories."

More information: P. A. Marquet et al. On Theory in Ecology, *BioScience* (2014). DOI: 10.1093/biosci/biu098

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