COMMUNICATIONS BRÈVES
≪ BIODIVERSITÉ DANS UN MONDE EN MOUVEMENT ≫
22–26 JUILLET, 2013

CONTRIBUTED TALKS
"BIODIVERSITY IN A CHANGING WORLD"
JULY 22–26, 2013

The importance of sensitivity analysis for theoretical and applied problems in community ecology

Gyorgy Barabas *
dysordys@umich.edu

Sensitivity analysis, which has had a long-standing and distinguished career within the context of population ecology, is in fact a very general methodological framework, which asks the question : given some variable of interest and certain parameters, how is the variable expected to respond to a change in the parameters ? There is ongoing research aimed at extending the methodology of sensitivity analysis from single populations to communities of interacting species. It turns out that there are at least three different levels of questions and problems that this framework can address. First, the framework maintains a surprisingly strong connection with some classical concepts within ecology—in particular, that of the ecological niche. On the more narrowly focused (but still theoretical) side, it can be used as a tool to gain insights into model behavior not obtainable via standard methods of model analysis. Finally, on the applied side, the framework can be used on models parametrized with data to get actual numerical estimates of extinction risk in response to a changing environment. We present applications to all three of the aforementioned problems. The niche theoretical approach is able to yield a categorization of when and what kinds of species differences are required to avoid competitive exclusion. To show what kinds of insights the framework can provide into model behavior, we analyze a model of intraspecific facilitation (Gross 2008) where it has been proven that there is no limit to the number of species that can stably coexist on a single limiting resource. We show that, though stability of the dynamics can indeed be ensured, the community will become more and more sensitive to external perturbations as more species are packed in, yielding a practical limit to the expected diversity. Finally, we apply the framework to a model of grass-forb interaction (Levine & Rees 2004), a model parametrized using field data. Here we explicitly calculate the expected responses of stationary states to model parameters. It turns out that this model is quite sensitive to a small number of key parameters such as forb seed mortality—pointing to the fact that these parameters needs to be measured very accurately to provide useful information about the system.

*Department of Ecology and Evolutionary Biology, University of Michigan, 830 North University Avenue, Ann Arbor, MI 48109-1048, USA.