Ecological and Lyapunov Stability

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Abstract

Ecologists have proposed several incompatible definitions of ecological stability. Emulating physicists, mathematical ecologists commonly define it as Lyapunov stability. This formalizes the problematic concept by integrating it into a well-developed mathematical theory. The formalization also seems to capture the intuition that ecological stability depends on how ecological systems respond to perturbation. Despite these advantages, this definition is flawed. Although Lyapunov stability adequately characterizes perturbation responses of systems typically studied in physics, it does not for ecological systems. This failure reveals a limitation of its underlying mathematical theory, and an important difference between dynamic systems modeling in physics and biology.

Keywords:	stability, ecology, Lyapunov, Liapunov, definition, perturbation, dynamic systems modeling
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