Ben-Gurion University of the Negev
Jacob Blaustein Institutes for Desert Research
The Swiss Institute for Dryland Environmental and Energy Research
Mitrani Department of Desert Ecology

Seminar

Ehud Meron

Department of Solar Energy
& Environmental Physics, BIDR

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Seminar Room, Old Administration Building

Ecological integrity: A dynamical-system approach

Humans constitute a dominant driver of ecosystem change in our current era (the "Anthropocene"). Unlike natural drivers of ecosystem change, which are erratic and unpredictable, human drivers generally involve planning and controlled management. Yet, the outcomes of human intervention are often detrimental to the ecosystems involved, diverting them from tracks of self-organization towards functional ecosystem states. An instrumental concept that has emerged in this context is that of ecological integrity—a system attribute that reflects the degree to which an ecosystem is self-organized in a functional state. While highlighting the natural tendency of ecosystems to self-organize in complex ecosystem states, most efforts have been devoted to the intricate question of how to assess ecological integrity leaving the inherent nonlinear self-organization dynamics unstudied. The significance of studying the dynamics of self-organization lies in the ability to uncover the inherent modes that drive self-organization, which, I argue, provide the basis for planning high-integrity human intervention. These self-organization modes represent combinations of state variables and their spatio-temporal forms that direct ecosystems toward various stable states, such as the periodic vegetation patterns in the picture. The thesis I will put forward is that by mathematical modeling of ecological contexts of interest and by exploiting methods of dynamical-systems theory to identify the self-organization modes and follow their dynamics, concrete suggestions for human intervention can be made that meet the requirement of high ecological integrity. I will demonstrate this approach using examples of range management and regime-shift control.