Ben-Gurion University of the Negev
Blaustein Institutes for Desert Research
The Swiss Institute for Dryland Environmental and Energy Research
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Title:

# Disturbances and stability in spatial ecosystems

Speaker:


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Abstract:


Ecosystems are not static, but are rather highly variable due to internal dynamics and external perturbations and disturbances. For this reason, many studies have investigated the stability properties of ecosystems using both theoretical and empirical approaches, and suggesting various measures of stability such as resilience, invariability and persistence. Spatial features play heavily into the question of stability, and much work has focused on relating stability to the ecosystems' spatial structure, spatial heterogeneity, scaling properties, etc. Disturbances are in general spatially heterogeneous, often markedly so, yet little work has focused on the relationship between disturbance structure and the overall stability and recovery properties of the ecosystem.

We investigate the role of a disturbance's spatial structure on the ecosystem's recovery dynamics, by considering its return time following a single disturbance. We unfold the recovery dynamics along two dimensions: self-recovery occurring on a local scale with no relation to space, and a rescue effect, mediated by dispersal, of the whole ecosystem on the perturbed region. This second process, regional recovery, occurs on a different and typically slower timescale than local recovery, and directly depends on the system's size. It can become the dominant response when local dynamics are highly non-linear and most strikingly so when the local dynamics have alternate stable states.

Accessing return times implies monitoring perturbations individually, something that is not always empirically feasible. We address this issue by relating return time to variability, caused by a repeated disturbance regime. We apply our findings to propose an indicator of bistability of ecosystems, given information on their response to different scales of disturbances. We also learn that mid-sized disturbances are more likely to lead to an overall ecosystem collapse, when the disturbances occur frequently. Overall we provide a comprehensive framework to understand the recovery dynamics of spatially extended ecosystems, predicting when regional recovery can be expected to be the dominant response to disturbances, and providing insight on what it can tell us on the resilience of spatially extended ecosystems.


Tuesday, April 4, 2017, 11:00
Lecture room, Physics Building (ground floor)