



Self-organization, fragility and thresholds in modelled semi-arid vegetation

Richard Bailey

School of Geography and the Environment, University of Oxford

Understanding the behaviour of complex environmental systems, particularly as critical thresholds are approached, is vital in many environmental contexts. Moisture-limited vegetation in semi-arid regions is one such system, important because of its susceptibility to stress-induced collapse, and also in supporting a large fraction of the World's human population. Estimating the proximity (in time) of approaching thresholds is an important but difficult task in both natural and modelled systems, made worse by the presence of variability (noise) in the forcing variables. Change in spatially self-organized vegetation patterning has previously been proposed as a means of identifying approaching thresholds in these contexts. However, spatial patterning of vegetation is by no means ubiquitous in semi-arid regions and further progress may be possible through other complementary lines of investigation. This presentation contains details of a newly-developed cellular automata model of semi-arid vegetation cover and its use in investigating the time-dependence of spatial self-organization and other temporal indicators of system fragility (and hence threshold proximity). The possibility of perturbation-induced cascades to bare ground (desert) states is also examined under different mean stress levels.