Geophysical Research Abstracts
Vol. 14, EGU2012-508, 2012
EGU General Assembly 2012

Self-organization in Shrublands' patterns along a climatic gradient: A geo-simulation and remote sensing Study

M. Shoshany

Technion, Israel Institute of Technology, Faculty of Civil & Environmental Engineering, Haifa, Israel (maximsh@tx.technion.ac.il, +97248295708)

Vast areas of shrublands across Mediterranean transition zones between arid and semi-arid regions are under degradation and desertification threats. Self-organization has a critical role in the resilience of these ecosystems, which was built through frequent disturbance-recovery cycles during the last few thousands of years. A distinctive number of studies found that Power-Law relationships maintained between the size of patches and their frequency are indicative of such self-organized behavior. This study further assess size-frequency relationships in shrublands across a transition zone between Mediterranean and arid regions. Implementation of Cellular Automata technique and extraction of chronosequences from historical air photographs provided information regarding modes of patch pattern changes according to change in relationships between average size versus frequency along disturbance – recovery cycles. Analyzing these modes revealed firstly that Power-Law relationships all along these cycles are linked to stochastic pattern evolution. Secondly, where recovery follow embedded gradients of soil moisture and organic matter content, there is a distinctive component of non-random growth related to patches' expansion. With increasing rainfall availability and water use efficiency this component increases as well, yielding growing deviation of the Average size - frequency relationships from the Power-Law line at the early stages of pattern recovery. A characteristic form of Patch size – Patch number variation emerge for these early stages before the pattern recovery converge to the Power-Law relationships.
The new form of patch pattern properties (size and frequency) variation allows better understanding of the modes of self-organized behavior in areas of transition from semi-arid to arid regions. Furthermore, it is possible to link changes in habitat conditions to changes in these modes of self-organized behavior. The role of embedded gradients of soil moisture and organic matter, their build-up during years of favorite habitat conditions and their contraction during disturbances or draughts seem to provide insight into the mechanisms of self-organization in water limited ecosystems.