Geophysical Research Abstracts
Vol. 13, EGU2011-9368, 2011
EGU General Assembly 2011

Geosimulation Based Modeling of Patch Pattern Dynamics and Shrublands' Biomass across semi-arid to arid Gradients

Maxim Shoshany

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

Water Use Efficiency (WUE) in shrublabds extending across semi-arid to arid gradients is highly dependent on the mutual properties of bare soil and vegetation patch patterns. Annual fluctuations in rainfall, temperature, grazing and wood cutting intensities together with frequent fires results most dynamic pattern changes. Loss of biomass productivity and reduction in shrubs' pattern recovery potential yields increased soil erosion which then further enhances desertification. A new model linking mutual soil-vegetation pattern properties, WUE and biomass-precipitation relationships was recently presented. Patch pattern properties were parameterized by the ratio between the area of isolated small plants together with those at the boundary of larger vegetation patches to the total vegetation area (edge-ratio). High edge-ratios are indicative of low WUE at the wide area scale. Multiplying the Mean Annual Precipitation (MAP) by this edge-ratio in an existing Biomass-Precipitation model may facilitate estimation of expected productivity along disturbance-recovery cycles across the semi-arid to arid climatic zones. Better understanding of Pattern-WUE-MAP-Biomass relationships is gained by implementing a process based approach utilizing Cellular Automata technique. Different modes of patch pattern evolution may be obtained by varying the relative amounts of vegetation area growth by spread of individual plants or by expansion of existing patches. This formed a virtual laboratory serving the study of the interaction between process modes, rainfall availability, pattern based Water Use Efficiency and ecosystems biomass productivity.
Coupling these geosimulations with patch pattern information from historical air photographs allowed for the reconstruction of the process modes operating along the climatic gradients in central Israel and the interpretation of the differences between expected biomass according to the generalized Biomass- Precipitation model and the actual biomass found in the field. The research findings elaborated the important role of patch pattern properties during both the recovery and degradation of desert fringe ecosystems.