Geophysical Research Abstracts, Vol. 9, 08188, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08188

Scaling in ecosystems and the linkage of macroecological laws

A. Rinaldo

Department IMAGE and International Centre for Hydrology "Dino Tonini" Universita' di Padova

Are there predictable linkages among macroecological laws regulating size and abundance of organisms that are ubiquitously supported by empirical observations and that ecologists treat traditionally as independent? Do fragmentation of habitats, or reduced supply of energy and matter, result in predictable changes on whole ecosystems as a function of their size? Using a coherent theoretical framework based on scaling theory, Banavar et al. (PRL, 2007) argue that the answer to both these questions is affirmative. In this solicited contribution, I shall build on their result to touch on a few issues possible relevant to the topic of the Session.

My concern here is with the comparatively simple situation of the steady state behavior of a fully developed ecosystem in which, over evolutionary time, resources are exploited in full, individual and collective metabolic needs are met and enough time has elapsed to produce a rough balance between speciation and extinction and ecological fluxes. While ecological patterns and processes often show great variation when viewed at different scales of space, time, organismic size and organizational complexity, there is also widespread evidence for the existence of scaling regularities as embedded in macroecological "laws" or rules. These laws have commanded considerable attention from the ecological community. Indeed they are central to ecological theory as they describe the features of complex adaptive systems shown by a number of biological systems, and perhaps for the investigation of the dynamic origin of scale invariance of natural forms in general. The species-area and relative species-abundance relations, the scaling of community and species' size spectra, the scaling of population densities with their mean body mass and the scaling of the largest organism with ecosystem size are examples of such laws.

Borrowing heavily from earlier successes in physics, Banavar et al. (2007) show how simple mathematical arguments, following from dimensional and finite-size scaling analyses, provide theoretical predictions of the inter- relationships among the species abundance relationship, the species-area relationship and community size spectra, in excellent accord with empirical data.

My conclusion is that that the proposed scaling framework, along with the questions and predictions it provides, serves as a starting point for a novel approach to macroecological analysis.