Geophysical Research Abstracts
Vol. 17, EGU2015-9736, 2015
EGU General Assembly 2015

Scaling Rules!

Dan Malkinson and Lea Wittenberg
Department of Geography and Enivronmental Studies, University of Haifa, Haifa, Israel

Scaling is a fundamental issue in any spatially or temporally hierarchical system. Defining domains and identifying the boundaries of the hierarchical levels may be a challenging task. Hierarchical systems may be broadly classified to two categories: compartmental and continuous ones. Examples of compartmental systems include: governments, companies, computerized networks, biological taxonomy and others. In such systems the compartments, and hence the various levels and their constituents are easily delineated. In contrast, in continuous systems, such as geomorphological, ecological or climatological ones, detecting the boundaries of the various levels may be difficult.

We propose that in continuous hierarchical systems a transition from one functional scale to another is associated with increased system variance. Crossing from a domain of one scale to the domain of another is associated with a transition or substitution of the dominant drivers operating in the system. Accordingly we suggest that crossing this boundary is characterized by increased variance, or a "variance leap", which stabilizes, until crossing to the next domain or hierarchy level.

To assess this we compiled sediment yield data from studies conducted at various spatial scales and from different environments. The studies were partitioned to ones conducted in undisturbed environments, and those conducted in disturbed environments, specifically by wildfires. The studies were conducted in plots as small as 1 m2, and watersheds larger than 555000 ha. Regressing sediment yield against plot size, and incrementally calculating the variance in the systems, enabled us to detect domains where variance values were exceedingly high. We propose that at these domains scale-crossing occurs, and the systems transition from one hierarchical level to another. Moreover, the degree of the "variance leaps" characterizes the degree of connectivity among the scales.