Network Allometry and Ecosystem Structure

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A new allometric scaling law for loopless networks, conformed through studies on rivers, exact network results and computer simulations, o_ers unique insight on a variety of phenomena, ranging from the ubiquity of the 'quarter-power' law in biology to the origin of scaling size spectra in marine microbial ecosystems, to the proper geomorphological description of a river basin. In a sense, networks are a byproduct of the hydrologic dynamics, which indeed is related to ecosystem structure by Ignacio Rodriguez-Iturbe's keynote address. *Si parva licet*, I will provide evidence suggesting that ensemble averaging of the allometric property (where individual realizations are different networks) leads to results in excellent accord with the known limit scaling of efficient and compact networks with remarkably little scat- ter with implications of somewhat general character. Such results comple- ment recent work suggesting that network-related allometric scaling in living organisms is regulated by metabolic supply-demand balance, because it is shown that scaling features are robust to geometrical fluctuations of network properties.

Moreover, network properties matter for ecosystem function and structure. For example, evaluating the component features of scaling (i.e. power law) planktonic size spectra, commonly observed in marine ecosystems, is crucial for understanding the ecological and evolutionary processes from which they emerge. I report on a theoretical framework which describes such spectra in terms of the size distributions of individual species, and test it against actual data sets of microbial size spectra from the Atlantic ocean. Characteristics of size probability distributions of component species are described that are sufficient to support the observational evidence and infer that, when a power-law describes the community size spectrum (thus suggesting critical self-organization of microbial ecosystem structure and function and a network structure of the underlying ecological interactions), a related power-law relates the total number of individuals of a given species to its mean size - an allometric rule.

Thus I concur with the master's suggestion that hydrologic dynamics mingles with ecosystem's structure, even if seen from another angle.

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