Physics approach to ecosystem dynamics

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Ecological communities exhibit pervasive patterns and interrelationships between size, abundance, and the availability of resources. Non-equilibrium statistical mechanics is the natural candidate to develop a unified framework for understanding the distribution of organism sizes, their energy use, and spatial distribution. We demonstrate that optimal use of resources, both at the individual and community level, leads to a consistent scaling theory of tropical forest whose prediction agrees with observational data and match perfectly with the scaling behavior of an exactly solvable self-similar model of a forest. The range, over which pure power law behavior is observed, depends on the available amount of resources. The scaling framework can be used for assessing the effects of natural and anthropogenic disturbances on ecosystem structure and functionality.

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