Project Summary

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I will use basic physical constraints to predict the general evolution of various organisms, and in particular this will consist of using localized physical conditions to predict how unique ecological and evolutionary traits are produced by specific environments. These environments are characterized by certain constraints and conditions. I am relating the structure of macro-ecology to the limitations faced by individuals forming ecological networks of interest. The individuals are described by the scaling theories produced by Geoffrey West, Brian Enquist, and James Brown, where the focus is on the general architecture and scaling of organisms (West et al.1997, Science). In particular, these theories describe an organism in terms of metabolism and volume-filling distribution networks that are optimized for geometry and efficiency. These principles have been applied to tree vascular networks, (West et al. 1999, Nature), and I have related the specifics of tree geometry to the resource needs of an individual tree. Thus it is possible to introduce the actual resources available and observe what the constraints are for any individual tree. I have written these relationships in a way that optimizes certain aspects of the tree, such that when we introduce actual resource availability we maximize desired features. There is a strong correlation between the maximum features of an individual and the entire demographics of an ecosystems. This is to say that the maximum feature sets how that feature is expressed in the rest of the community. Thus it will be possible to use these maximum features to describe the entire ecology of an ecosystem.