

KS14 - John Harte (University of California, Berkeley - USA)

Pattern and Process in the Distribution and Abundance of Species

Abstract:

Ecologists seek to understand the forces that govern the Distribution and Abundance of Species (DAS) across a wide range of spatial and temporal scales. While extensive DAS data exist, there is little agreement among ecologists about either the prevalent patterns or the dominant ecological processes that shape observed patterns. I first review the array of metrics used in ecology to describe scaling patterns in the DAS, including both metrics that apply to individual species and metrics of community structure. I then present an historical and critical review of hypothesized patterns, and of mechanisms that might generate such patterns, emphasizing the gap between current understanding and the goal of a truly comprehensive and unified theory. As an aside, I next pose and briefly discuss the question of whether ecology is actually more like physics or like history, because only in the former case is a continuing search for such a unified theory likely to succeed. Ecologists are divided about the answer to this, but the answer that I defend here then leads naturally to the second half of my talk: presentation of the outlines of a unified theory of the DAS. After describing in general terms what a unified theory of ecology would look like if we had one, I show that the central tendencies of observed DAS patterns are well captured by the Laplace/Gibbs/Shannon/Jaynes maximum entropy principle (MaxEnt), a logical cornerstone of science. In MaxEnt, processes or mechanisms that determine probability distributions of pattern are represented by constraint equations; I conclude with an open-ended discussion of whether most ecological mechanisms can be captured by constraints or whether the power of MaxEnt in ecology is destined to be merely a sideshow.