Non-linearity, variability and diversity: an integrative perspective

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The theme of my lectures will be on the interplay between non-linearity and variability in driving species diversity. Non-linearities arise when biotic factors generate density- or frequency dependence in fitness (per capita growth rate). Variability arises when abiotic factors modify these non-linearities, generating spatial or temporal variation in fitness. The large-scale patterns we see in nature is the result of this interplay between non-linearity and variability. My lectures will illustrate (i) how we can use mathematical models of population dynamics, species interactions, and phenotypic evolution to elucidate the mechanistic underpinnings of interplay between non-linearity and variability, and (ii) use such mechanistic theory to predict how organisms respond to perturbations in their biotic and abiotic environment (e.g., climate warming, species invasions).