Using spatial structural equation modeling as a novel approach to understanding primate community composition and diversity.

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Primate community composition and diversity has largely been explained by three separate processes: (1) niche-based processes (deterministic), (2) dispersal limitation and environmental stochasticity (stochastic), and (3) biogeographic dispersal barriers (biogeographic processes). However, no communities are shaped purely by a single process and discerning the extent to which these processes affect community composition is not possible without the use of an integrated model. Here I show how spatial structural equation modeling (SSEM) is a novel approach for estimating the roles of deterministic, stochastic, and biogeographic processes on measures of community composition and diversity, while also considering spatial dependence. SSEM allows for the examination of causal links and spatial dependence in models of process and community metrics simultaneously. SSEM is an extension of structural equation modeling (SEM), and allows for explicit modeling and testing of theoretical considerations underlying the spatial structure of the data. In contrast to traditional multiple regression models (which can only deal with one response variable), SEMs allow the consideration of hypothesized causal relationships in datasets with more than one dependent variable and the effects of dependent variables on one another. I provide an SSEM of the processes that shape primate and mammal community composition and diversity in Madagascar and Australia. Understanding the roles deterministic, stochastic, and biogeographic processes have in determining patterns of diversity have practical implications for predicting community responses to anthropogenic change and for distinguishing the extent to which each process has shaped both extinct and extant communities.

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