Functional island biogeography: the next frontier in island biology

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Abstract

Island biota exhibit a fascinating diversity of form and function, and the specular morphological and behavioral oddities of island species compared to mainland relatives have received considerable scientific interest. Interestingly, all influential theories in island biogeography including the Equilibrium Theory and the General Dynamic Model of Island Biogeography do not consider such differences in species traits but instead treat all species as functionally equivalent. Such an ecologically neutral perspective clearly represents an oversimplification of the nature of island biota and limits our ability to understand the complex interplay of processes underpinning the distribution and diversity of island species and to predict how island species are affected by global environmental change. The large body of literature that exists on traits associated with dispersal and colonization, island syndromes (e.g. derived island woodiness, disharmony) or convergent trait evolution on different islands, however, currently lacks a coherent framework. Here, we argue that islands are particularly suited for a trait-based approach to study how different dispersal and environmental filters shape species assemblages at different spatial scales and how functional diversity emerges over time. We propose functional island biogeography, as an emerging sub-discipline that studies the distribution and composition of traits and functional diversity of island organisms across different organizational levels, and argue that this approach has great potential to link currently disparate areas of island research at the interface of functional ecology, biogeography and evolutionary biology. Moreover, functional island biogeography might offer new insights into the consequences of species losses and introductions on the functioning or island ecosystems. Building on recent case studies, we show how functional island biogeography can take advantage of existing eco-informatics tools, databases, and standardized field sampling protocols and how this opens new avenues of research by integrating information about species distributions, abundances, and functional traits.

Keywords: island syndromes, functional diversity, functional island biogeography, traits

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