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Biogeography of a fragmenting world

Part of the value of biogeography as a multidisciplinary transversal science is its wide applicability to processes that occur at multiple scales. One such process is the extinction of species resulting from the disappearance of their habitats. Habitat loss and fragmentation are widespread, and, together with habitat degradation and other human impacts, they probably constitute the aspect of global change that contributes the most to current extinction rates (see, e.g., Sandom et al. 2014), although climate change and biological invasions also play significant roles in changing the ecological dynamics of species (see the book reviews by Hinsley 2015 and Cassey 2015 in this issue).

Island biogeography is particularly useful for understanding the complex effects of habitat loss and fragmentation on biodiversity, for it provides a solid theoretical background to study and model extinction trends (Harris 1984). Using this conceptual framework, Matthews (2015) studied different aspects of biodiversity variation in habitat fragments, finding that trends in these habitat islands are complex and change from one system to another, with traditional island biogeographic relationships only being applicable to a very limited extent. Importantly, some of this lack of transferability can be attributed to the effects of non-native species or the characteristics of human disturbance, rather than to a lack of generality of the principles of island biogeography. Further, the nature and extent of habitat degradation in the matrix surrounding the habitat islands turn out to be important in Matthews' (2015) research, adding a new dimension to island biogeographic enquiry. High-quality datasets such as the one provided by Bergamin et al. (2015) for the vegetation of the highly fragmented Brazilian Atlantic forest will further enhance our knowledge about the effects of habitat transformation on biodiversity loss.

Islands can also contribute to the study of habitat change and extinctions in that they can act as natural experiments, where isolation has resulted in the existence of many (pseudo)replicates of limited size with similar ecological conditions and similar but, at the same time, independent evolutionary processes and species pools. The work of Lavery (2015) on northern Melanesian mammals is a nice example of how the distribution, ecology and evolution of several groups and lineages can be studied from a holistic, multidisciplinary perspective in archipelagos and island complexes. This integrative perspective is also adopted for the study of particular biomes, such as the South African Fynbos (Ojeda 2015), but is particularly difficult when these biomes occupy large areas or are located in areas with considerable biotic interchange.

Some of the complexity of continental settings can be untangled by studying areas of intermediate isolation, such as peninsulas, and explicitly addressing temporal patterns. The combination of data on past (through pollen) and current distribution of species with macroecological and multivariate analyses allow Gavin (2015) to study the stability of habitats in the Olympic Peninsula (Washington, USA) throughout the end of the Pleistocene and the Holocene. At a larger temporal scale, the macroevolutionary study of extinction risk allows understanding of which species may be more prone to extinction, although habitat loss continues to play a major role in determining which species may be finally lost (DeNeve et al. 2015). Here, the important development of statistical tools to analyse temporal and spatial data (Dale & Fortin 2015, Hartig 2015) allows understanding of trends and drivers from multiple sources of data. A multidisciplinary approach, using transversal frameworks and addressing topics of broad interest to biogeographers, can perhaps best account for the many facets of the impacts of global change. This major strength of biogeography is nicely encapsulated by the papers within this issue of *Frontiers of Biogeography*.

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