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Celebrating the diversity of biogeographical research Special issue: International Biogeography Society, 4th biennial meeting

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Biogeography aims to understand the temporal and spatial distribution of life on Earth. Biogeographical research is aimed not only at describing where organisms live, at what densities, with whom, and how it all relates to the environmental and geographical setting but also why this is so. The International Biogeography Society, IBS, is a young and vibrant international and interdisciplinary society contributing to the advancement of all studies of the geography of nature, including spatial ecology (<www.biogeography.org>). In January 2009, the 4th International Conference of the International Biogeography Society took place in Merida on the Yucatan Peninsula, Mexico. Ecography provided financial support, acting as the sponsor of the Symposium of Extinction Biogeography and contributing to student travel awards. In addition, Ecography was the officially designated journal for publishing some of the many exciting talks and posters presented at the conference. All of the papers in this special issue of Ecography arose from the IBS conference. They have all been subject to external peer review, subsequent revision, and final editorial decisions of acceptance/rejection.

The special issue starts with an article by the local organizers (Vazquez-Dominguez and Arita 2010) that provides an introduction and overview of the biogeographic history of the Yucatan Peninsula, the setting of the conference before it delves into a series of 22 papers that represents the diversity of what constitutes biogeographical research in the 21st century.

The first series of papers focuses on speciation, extinction and migration as the three key principal forces that drive the distribution of biological diversity. Understanding when, how and where new species arise is of fundamental importance to our basic understanding of biodiversity on Earth. Reconstructing the evolutionary history of the family Oriolidae by generating a molecular phylogeny based on both nuclear and mitochondrial DNA sequence data, Jønsson et al. (2010) shed new light on how species in this clade dispersed first from their Australian area of origin to Asia and then onwards to Africa before back-colonising Asia and the Indonesian archipelago. The hypothesis that diversification rates are higher in active than in passive tectonic settings is explored in the paper by Badgley (2010), and Casner and Pyrcz (2010) show that speciation of butterflies in tropical mountain regions occurs primarily within elevational bands. Using a global database on the world's amphibians, Hof et al. (2010) find an indication of historical signals in the realized climatic niches of species.

Understanding past and current extinctions and their spatio-temporal dynamics is of tremendous direct interest, but insight from such studies is also of importance in understanding the impacts of contemporary and future global changes in land use and climate on species. Southern European peninsulas, for example, were traditionally recognized as glacial refugia where many species survived during the ice ages. In a study using species distribution models in a phylogeographical research framework, Vega et al. (2010) challenge this view by showing that it is plausible that the pygmy shrew had northern refugia during the Last Glacial Maximum. However, climate change was not the only factor affecting global or local extinctions during the Late Quaternary. Humans were also a well-known factor causing the extinction of species, mainly on islands, where humans have disrupted key ecosystem functions. To minimize the unwarranted effect of disrupted ecosystem functioning, Hansen et al. (2010) propose that humans should actively replace extinct taxa by introducing analogue taxa with presumed similar ecological functions as the extinct species. They illustrate this approach with some taxon substitution projects on islands using large tortoises as examples. Also on islands, the dramatic extinction debt revealed by Triantis et al. (2010) calls for better management, including the restoration and expansion of native forests. Species living at the top of mountains are like oceanic

islands in that they are also expected to be highly exposed to extinctions because there appears to be nowhere to migrate upwards when lower altitudes warm up as a consequence of global warming. However, upward migrations of species tracking climate change may not be the only possible scenario; some species could go against the flow. Lenoir et al. (2010), focusing on the latter, discuss potential mechanisms for unexpected downward range shifts of mountain plant species under climate change. The impact of climate change on species distribution has traditionally been attempted by using species distribution modeling, but the usefulness of this model approach may well be affected by the uncertainty embedded in the climate models used to forecast future climatic conditions (Real et al. 2010).

Migration of species through evolutionary and ecological time has profoundly shaped biogeographical patterns at different scales, from populations to whole continental biotas. Using 240 datasets, Jenkins et al. (2010) show that in the era of landscape genetics, ''isolation by distance'' still matters in modern population genetics. Migrations across biogeographic boundaries such us the Great American Biotic Interchange, have profoundly shaped current patterns of biological diversity in the New World. In a Special Feature within this special issue, introduced by Riddle and Hafner (2010), a small series of papers focus on understanding the timing and the biological consequences of the Great American Biotic Interchange (Cody et al. 2010, Smith and Klicka 2010), on the vicariance processes in Middle America (Daza et al. 2010), and on the biogeographic patterns across the Mexican Transition Zone (Morrone 2010). These contributions provide novel results and illustrate fresh research venues to revisit traditional biogeographical questions that are rooted in the research legacy of classical biogeographers such as Alfred Russel Wallace (Riddle and Hafner 2010).

Speciation, extinction and dispersal in interaction with the dynamics of abiotic and ecological processes are traditionally viewed as what determine current biogeographical patterns, including life history traits. Different approaches to study body size patterns and their drivers in Pacific island birds are explored by Olalla-Tárraga et al. (2010) and Boyer and Jetz (2010), respectively. These studies are followed by a study assessing factors thought to cause patterns in the geographical distribution of African palm species (Blach-Overgaard et al. 2010), and a study assessing the interspecific range size variability of butterflies in relation to life history traits and geographic features of species distributions (Garcia-Barros and Romo Benito 2010).

Not only do the distribution of species and patterns of diversity vary in time and space, so do the derived and underlying distributions of geographical ranges sizes of species assemblages. Krabbe Borregaard and Rahbek (2010) highlight the potential of using range-diversity plots for generating and testing hypotheses about how general ecological processes shape the location and size of species ranges and species richness. The study illustrates that much is still to be learned concerning the causes of large-scale patterns of species richness, a theme which is also the focus of Kreft et al.'s (2010) study on the global species richness pattern of ferns and seed plants. They suggested that taxon-specific ecological and life-history traits play an important role in defining global richness gradients. Another classic research area of biogeography is the relationship between richness and area. In the last paper of the special issue, Guilhaumon et al. (2010) has contributed as a Software note, an R-package that allows users to easily implement model selection and parameter estimation to assess uncertainties in species–area-relationship models.

This special issue illustrates the current convergence of different academic fields such as evolutionary biology, ecology, phylogeography, and global change biology within a biogeographic framework to explain large scale patterns of biological diversity. The holistic nature of biogeography constitutes both a challenge but also an exciting opportunity for inter-disciplinary research. In light of the ongoing species extinction crisis caused primarily by habitat alteration and global changes in land-use with the recent added focus on the impact of global changes in climate on biological systems, a diverse research program is as important and relevant as ever in the history of biogeographical research. We hope that this special issue, presenting and promoting presentations at the International Biogeography Society's conference in 2009 as peer-reviewed scientific journal papers, will contribute to a more thorough understanding of life on Earth.

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