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symposium summary — a perspective from two delegates

Biogeography and ecology: two lenses in one telescope

A symposium at the 5th International Biogeography Society Conference – Heraklion, Greece, 7–11 January 2011

The heterogeneous distribution of life on Earth is a ubiquitous pattern, but knowledge about causal factors remains elusive. Questions regarding this pattern have been traditionally addressed with different approaches, namely historic (biogeographical) vs. contemporary (ecological). Often, these perspectives were considered separate since each recognized different processes responsible for biological diversity, geography and history on one side and ecological interactions and climate on the other. This created a chasm between ecology and biogeography that remained from the maturation of ecology during the 1960's until recent years (Wiens and Donoghue 2004). Recognition of scale as an object of study instead of a nuisance in ecological studies (Wiens 1989) and the broadening perspective of ecological systems being influenced by both biogeographical and ecological contexts (Ricklefs and Schluter 1993) paved the way to acknowledge the interaction of regional effects on local patterns and vice versa. Consequently, the development of new concepts and disciplines (e.g. neutral theory, macroecology), along with analytical techniques and data availability (e.g. phylogenetic reconstruction), have helped bridge the gap towards a comprehensive understanding of biodiversity patterns. As an example of such bridging, Dave Jenkins and Bob Ricklefs convened a symposium during the 5th IBS meeting, in Crete, Greece, that showed progress in this direction. Here, we give a brief overview of this Symposium through the lenses of two biogeographers in-training.

A major constraint to the evaluation of the effect of biogeographic factors in local communities is the lack of manipulative ways to address their influence. Null modelling approaches have provided a framework to distinguish potential processes involved in community assembly when experiments are not possible. Jon Chase presented an example of combining these approaches with actual experiments. He showed that integration of null models and controlled experiments under a regional perspective aids in disentangling the relative effects of niche and stochastic processes in biogeography. His results of experiments in freshwater ponds reveal the effect of niche-based processes in lower productivity systems and stochastic processes (i.e. drift) at higher productivities. In the same vein, Evan Weiher presented results of a unique large-scale experiment evaluating the relative influence of dif-

ferent factors in community assembly. Through the analysis of functional parameters, Weiher found support for biotic interactions as important processes in shaping community functional traits, indicating that traits, beside phylogenetics, are necessary for understanding the mechanistic structure of communities.

Morphological or functional traits are obvious candidates for examining the relationship between species characteristics and their ecological and biogeographic patterns. A trait that has been favoured for its obvious ecological and evolutionary importance is body size. Felisa Smith presented the current knowledge regarding past and present body-size patterns in mammals from a macroecological perspective. Her presentation showed how such patterns have changed through time in different continents and the potential effect of human intervention in shaping them. Her approach emphasized the need to integrate different perspectives (e.g. reproductive physiology) at large geographic and taxonomic scales in the search for general patterns and processes across space and time. The assessment of such biodiversity patterns has relied mostly on species richness as the standard metric (as response variable). In his presentation, Alessandro Chiarucci argued that standardized methods to assess and monitor biodiversity applicable to both ecological and biogeographical perspectives are actually lacking. He suggested a solution based on improving data gathering, basically following an "*ecological lens across units typical to biogeographical studies*".

An important contribution in merging ecology and biogeography has been the application of the niche concept (ecology driven), in the study of biogeographic patterns (history driven). John J. Wiens showed that the niche concept has profound effects on our understanding of biodiversity patterns. Wiens suggested that niches influence biogeographic patterns mainly through limits on dispersal determined by ecological conditions. He also presented examples combining large-scale biogeography, ecological traits and phylogenies that illustrate the combination of ecological and biogeographical perspectives. The basic premise behind niche influence on biogeography is that environmental preferences between closely related species are similar as a result of phylogenetic conservatism. Such influence of phylogeny has also been acknowledged in the assessment of aggregate statistical patterns mainly in relation to statistical (non) independence of species and how to control for it. Robert Poulin presented an excellent example considering this influence in comparative analyses. He showed how controlling for phylogenetic influences helps reveal geographic patterns in species traits, such as range size and niche breadth. This highlights the importance of obtaining and incorporating phylogenetic information to the study of biodiversity patterns in space and time. The recent increase in availability of phylogenetic information, mediated by technological and analytical advancements, has fostered its use at a range of scales from individual organisms and populations to species assemblages and regional biotas—adding an evolutionary dimension in pattern description and explanation. The contributions by Brent Emerson and Jonathan Davies illustrated this fact. Brent Emerson showed how new techniques in molecular sequencing allow description of species relationships, which in turn facilitates a detailed inspection of assembly patterns. His framework offers a way to connect phylogeography, biogeography and community assembly and has wide applicability. Likewise, Jonathan Davies presented results from incorporating evolutionary hypotheses (particular phylogenies) to explain contemporary patterns of geographic variation in species richness. By contrasting phylogenetic diversity and species richness, Davies showed how distinct regions might hold similar species numbers but still differ in their phylogenetic diversity. This, he argued, can inform about the historical aspect of biodiversity, a feature that has recently gained importance in conservation goals.

Overall, the series of contributions presented at this Symposium represents an step towards the integration of biogeography and ecology to increase our understanding of biodiversity patterns. Although such steps have come mostly (but not exclusively) from the ecological side towards biogeography, they have certainly clarified

the intrinsic relationship between both disciplines and have shown how they are, indeed, two lenses in one telescope.

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symposium summary

Mediterranean biogeography: where history meets ecology across scales

A symposium at the 5th International Biogeography Society Conference – Heraklion, Greece, 7–11 January 2011

The Mediterranean Basin looks almost designed as a model system for biogeographical research. It is a semi-closed sea offering coast to three continents and 24 countries, with a marine surface area of some 2,500,000 km^2, a maximum depth of 5,121 m, and a coastline of 46,500 km. 24,600 km of this coastline belong to the 11,879 Mediterranean islands, 243 of which host permanent human populations. Even though there has been some disagreement on the precise definition of what constitutes the terrestrial Mediterranean Region, the dominant view includes some 2,300,000 km^2 of land around the basin (Blondel et al. 2010).

An important aspect of the Mediterranean Region is its long history of human presence that spans several millennia, with agriculture being practiced in the region for approximately 10,000 years, and the sequential rise and fall of many important civilizations, especially during the past 5,000 years. Another crucial feature is the intensive tectonic activity caused by the subsidence of the African plate beneath the European plate, and the strong east-west pressures to Asia Minor exerted by the Arabian plate. The palaeogeography of the Mediterranean Region is also complex, and highly marked by the Messinian Salinity Crisis. During this key event the Gibraltar strait closed and the Mediterranean Sea was reduced to a series of saline lakes for some 630,000 years (5.96-5.33 Ma), leading to large-scale changes in both marine and terrestrial biota. The unique combination of geological and climatic factors has led to the development of a characteristic and highly diverse biota, as reflected by the inclusion of the Mediterranean among the most important biodiversity hotspots. The vast biotic diversity and the complexity of processes shaping Mediterranean biodiversity are reflected also in the diversity of approaches to the biogeography of the region, a small sample of which were covered in this Symposium.

Hans Peter Comes from the Paris-Lodron University of Salzburg (Austria) explored processes of plant speciation in the Mediterranean, contrasting patterns of adaptive and non-adaptive radiations. Ecological speciation plays an important role in Mediterranean plant radiations, both old and young, with radiation often accompanied by niche differentiation amongst lineage members. Nevertheless, at least one case of purported 'non-adaptive radiation' in plants has been suggested, with mutation and genetic drift being the primary factors causing divergence of populations occupying ecologically similar habitats: the *Nigella*