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frontiers of biogeography aims to be a forum for biogeographers and a way to disseminate research in biogeography to the general public; our scope includes research updates and reviews, opinions and perspectives, interviews, articles on how to teach, disseminate and/or apply biogeographical knowledge, but not original research results based on data (see editorial instructions); submissions and editorial requests are welcome at frontiersofbiogeography@gmail.com and ibs@mncn.csic.es

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cover: Butterfly logo designed by Mark V. Lomolino for the original Frontiers of Biogeography book, which we are adopting as the logo of this new journal. See the editorial at pp. 3-4 for further details.
Welcome to the first issue of *Frontiers of Biogeography* - the scientific magazine of the International Biogeography Society. The birth of this publication marks another major stage in the growth of the Society, one that reflects on our history and looks to the future. The magazine results from joining two prior publications: [1] the *IBS newsletter*, which grew from an update of Society business in 2003 to a publication on current affairs in biogeography by 2008, and [2] the *Frontiers of Biogeography* series, initiated by Mark Lomolino and Lawrence Heaney to publish the symposia of the first annual meeting of the IBS (see Heaney and Lomolino this issue). In conjoining, the magazine will fulfil the goal of the original *Frontiers of Biogeography* book: to provide a series of integrative and interdisciplinary volumes published and developed in association with the International Biogeography Society (Lomolino and Heaney 2004).

The title, *Frontiers of Biogeography*, was chosen to convey the message that this publication will follow the lead of its predecessors, including diverse contributions on the state-of-the-art and the future of research in biogeography plus its practical application. The magazine aims to distinguish itself from existing biogeography journals by providing an eminent forum for syntheses and prospectives that will push forward the boundaries of biogeography philosophy and practice. We aim to demonstrate not simply how biogeography is being done – existing journals already do this wonderfully – but rather to offer insights into how it has been, and how it might be, done. *Frontiers of Biogeography* will, therefore, publish texts that include new ideas, novel ways to think about existing information, and innovative ways to practice biogeography rather than studies collecting new data which are the cornerstones of existing journals. You can see a condensed description of the sections in the next page. We aim to foster discussion across the field by bringing together diverse topics under one title, and to promote debate by publishing substantiated but perhaps controversial opinions.

The subtitle, ‘the scientific magazine of the International Biogeography Society’ was chosen to communicate that this will be a place where you – whatever your walk of life – can find rigorous science in an easy-to-read format. Everyone is busy, so our goal is to bring a sample of the best in biogeography to you. By adopting a lighter reading format, we aim to bridge gaps between researchers, practitioners, and those with different interests. The magazine is created by and for biogeographers of all kinds: graduate students, postdocs, faculty, and other researchers who study the geography of nature, including ecologists, evolutionary biologists, paleontologists and conservation biologists. It can only be a success if it continues the tradition of the International Biogeography Society, IBS Newsletter, and *Frontiers of Biogeography* book of engaging junior and senior biogeographers around the globe. As well as reading and enjoying the magazine, we hope you will contribute!

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References
General aims and sections

*Frontiers of biogeography* aims to be a forum for biogeographers and a way to disseminate research in biogeography to a broader audience. As such, we welcome any contributions coming from biogeographers or other persons interested in biogeography or applying biogeographical knowledge, either members of the International Biogeography Society (IBS) or not.

Our scope includes research updates and mini-reviews, opinions and perspectives, interviews, articles on how to teach, disseminate and/or apply biogeographical knowledge, but not original research results based on data. Regular research papers based on new data and analyses should be submitted to other journals.

Due to its diversity of objectives, *Frontiers of Biogeography* includes a number of sections of varied aims and focus:

- **News and update** aims to provide a digest on the most recent research, including easy-to-read digests of current state of the art, and more technical content including commentaries, dissertation abstracts, book reviews or summaries of workshops and symposia.

- **Profiles** will include interviews of high-profile biogeographers, or thematic series of interviews, such as the currently ongoing conservation biogeography forum.

- The **Opinion and Perspectives** section is intended to be a forum for debate, publishing papers that question current lines of research, theories, methodologies or ‘schools of thought’, or summaries of the *Perspectives* of established researchers on broad areas of research.

- Other section intends to announce, highlight and promote the new **Resources** available for research in biogeography or the dissemination of biogeographical knowledge. This section will also host summaries of the state of the art on varied topics in the form of *Mini-reviews*, allowing an up-to-date general knowledge of the diversity of research subjects that compose modern biogeography, and helping students and/or professionals to start working in a new topic.

- General and easy-to-read knowledge on many biogeographical matters will be provided by **Agora**, a section providing digest articles where research in biogeography is explained in an easy way, and articles on how to communicate and teach biogeography.

- Being also a service of the IBS, the journal will include a **Membership corner** with information for the members and IBS activities, and will also accept general **Announcements** on forthcoming meetings, courses, etc.

Before preparing a manuscript for *Frontiers of biogeography*, please identify the type of article you intend to submit, and whether a pre-submission enquiry is required or not. Complete editorial information with instructions for authors is provided at [http://www.biogeography.org/html/fb_authors.html](http://www.biogeography.org/html/fb_authors.html). Submissions of pictures or maps independently from articles are also welcome. Submissions and enquiries should be done by e-mail to the editor-in-chief through the e-mails ibs@mncn.csic.es or frontiersofbiogeography@gmail.com.

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Your participation in *frontiers of biogeography* is encouraged. Please send us your articles, comments and/or reviews, as well as pictures, drawings and/or cartoons. We are also open to suggestions on content and/or structure.

Please check [http://www.biogeography.org/html/fb.html](http://www.biogeography.org/html/fb.html) for more information, or contact us at ibs@mncn.csic.es and frontiersofbiogeography@gmail.com.
The investigation of patterns of biological diversity on earth, a topic that has been a focal point of study for over two hundred years, has arguably come to a single predominant conclusion: the distribution of organisms has been dynamic over time, changing as a result of the changing geological face of the earth, the changing climate of the earth, and the dynamic nature of the organisms themselves. At a meeting held at National Center for Ecological Analysis and Synthesis in Santa Barbara, California in September 2001, which was held principally to organize a volume on the Foundations of Biogeography (Lomolino et al. 2004), it was abundantly clear that the field of biogeography had not only an illustrious past, but was entering an exciting and potentially transformative stage of development.

Two decisions were reached quickly at that meeting in Santa Barbara: 1) to organize a new society that would provide a forum for biogeographers world-wide to meet regularly and exchange new ideas and methods, and 2) to publish a volume that would exemplify the emerging concepts and identify the most promising directions for future research. The International Biogeography Society (IBS) held its first meeting in Mesquite, Nevada in 2003, and the papers presented during its symposia became the basis for a book, “Frontiers of Biogeography: New Directions in the Geography of Nature”, which we were honored to organize and edit for publication (Lomolino and Heaney 2004). Thus, the IBS and the recognition of continued dynamic development of conceptual issues in biogeography have been intertwined since the origin of the society.

The title of the book was one that we considered carefully. It is our sense that much about biogeography remains unknown, and that both patterns and processes that are of fundamental importance may, even today, be entirely unknown or existing only as a glimmer in someone’s mind. Thus, we wished to choose a title that emphasized that the field was entering an exciting period of great discovery, rather than one of confirmation of past ideas and a state of final resolution. The selection of the term “frontiers” was made deliberately for its implication of vast unknown spaces where wondrous things might be found. Rapid advances in increasingly detailed knowledge of the earth’s geological history, especially its tectonic history, continued to overturn previous concepts, and study of superb new fossil material has allowed a resurgence in paleobiogeography. Rapid increases in the ease and speed of conducting studies using DNA sequencing technology has created the new field of phylogeography, which has given us bold new perspectives on the history of diversification and distribution patterns all over the globe. The dynamics that underlie patterns of species richness, especially on islands and along elevational gradients, have changed rapidly as new data have emerged and new questions have provided new insights that have in turn led to still more new questions. There is a growing recognition that marine and terrestrial biogeography, long discussed in different journals using different terminology, have a great deal in common and will provide reciprocal illumination in many respects. And a new term and topic of focus emerged that recognizes the value of the data and issues that
biogeographers address relative to the menacing environmental problems that we face, “conservation biogeography”.

It is in the spirit of the first conference of the IBS and of the “Frontiers of Biogeography” volume that the former “IBS Newsletter” is now being renamed. Several current journals have contributed greatly to the recent growth and excitement about the field of biogeography, and it is our hope that they will continue to provide a venue for leading research in the field. But the surge in publications citing “biogeography” as a key word is evidence of the steadily growing need for multiple venues, and it seems eminently reasonable for the IBS to take a leadership role in providing one such venue. Thus, as explained at greater length elsewhere in this issue, it is the intent of the editors of this journal and the officers of the International Biogeography Society to foster the growth of this former newsletter into a format that will gradually take on increasing prominence in the field, providing a forum in which the frontiers of biogeography will be explored with vigor. As with the process of biological diversification, the development will occur over time, and may take unanticipated directions - but we view the prospect of the new journal with the same sense of enthusiasm that we felt at the meetings in Santa Barbara in 2001 and Mesquite in 2003. New vistas are opening, and we look forward to the directions in which they will take us.

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References
The importance of glacial refugia in structuring biodiversity has long been recognised. By allowing local persistence during past glacial periods, these areas were instrumental in retaining diversity at global to local scales, from the genetic variation within species to the diversity of species themselves.

Based on a combined analysis of phylogeographical studies conducted on 82 plant species occurring in the Mediterranean region and beyond, Frédéric Médail and Katia Diadema present evidence of 52 putative refugia throughout the region. Their work represents a step-change in the resolution of refugia in the Mediterranean, offering a fine scale localisation, where individual studies have often resolved their location no further than the major peninsulas.

Médail and Diadema consider the characteristics of refugia, highlighting the great importance of the Mediterranean mountain regions. From a thoughtful commentary of how multiple episodes of past climatic and other environmental changes have impacted diversity and the distribution of species, they suggest that the title of ‘glacial refugium’ might be seen as rather a simplification, with ‘cumulative refugia’ perhaps being more appropriate for the areas they define. The great evolutionary importance of refugia is discussed, with refugia acting both as storehouses of evolutionary history and reservoirs of genetic diversity for the future.

In the Mediterranean, refugia occur predominantly at the rear or ‘hot and dry’ edge of the distribution of many of their component species. Thus in a period where rapidly rising global temperatures dominate much of our thinking, it is tempting to dismiss the biodiversity of these regions as condemned and attempts at their conservation as futile. However, as the authors remark, the high environmental complexity of refugia that has facilitated the persistence of species throughout environmental changes experienced over past millennia, clearly demonstrates that the fate of these rear edge populations is far from sealed.

When we combine the possibility that populations might survive future changes in climate in these refugial areas with their exceptional evolutionary importance, we gain a clear understanding of why their conservation is so important. The observation by the authors that a high proportion of Mediterranean refugia are located in regions of high population and human land use pressure should then give us significant cause for concern. However, it is the finer geographical resolution of refugial areas that this paper provides that also paves the way for developing more effective strategies for their conservation.

Individual species have been impacted by individual climatic and biogeographic events in different ways, as the authors acknowledge. Further study in this region will uncover yet greater complexity and might modify the described patterns to some extent, as the difference between this paper and some of its predecessors demonstrates. However, the refugial areas that the authors define represent a significant advance in our understanding of both the historical and contemporary biogeography of plants in the Mediterranean, and confirm the great importance of the region for the biodiversity of the future.


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Edited by Antje Ahrends
Botanists have long been stuck on the flora agenda, collecting and cataloging plants, and eventually producing narrative explanations of distributions. With increased data access and new analytic tools, the approach is now rapidly changing towards synthesis of more general character.

A recent paper in PNAS, by Alexandre Antonelli and colleagues improves the standard set of tools for biogeographic reconstruction. The core of this paper is a molecular phylogeny of the coffee family (Rubiaceae), with broad taxon sampling but main focus on the Neotropics. The incredible biodiversity of this region is often explained from the extent and geological age of its rainforests, and from niche conservatism, whereby the once-widespread tropical biomes became restricted to low latitudes after the global cooling at the Eocene-Oligocene transition. The Andes is often assumed to have played a big role in South America, although it is poorly understood, first of all because the orogeny was often considered as a single, time-limited event. Little attention has been given to the fact that discrete geological structures were uplifted at different times, and to how the mountains affected the climate of adjacent lowlands and constrained dispersal within the lowlands. Montane biotas are often assumed to be young, recruited from adjacent lowlands, but mountains also seem to play a role as crates of biodiversity and dispersal centers.

The study presents standard parsimony and Bayesian phylogenetic analysis and a likelihood estimation of evolutionary time. Building on Ronquist’s DIVA program, Johan Nylander developed a new tool for biogeographic reconstruction, which uses a Bayesian sample of highly probable trees, thereby generating credibility support values for alternative relationships. Thus, even with partially resolved trees and incomplete taxon sampling, the method provides very stable reconstructions of ancestral areas for the different phylogenetic nodes.

The combined chronogram and biogeographic analysis demonstrates: (1) an old world origin of the Rubiaceae with dispersal to North America, before the opening of the North Atlantic in the Eocene, and (2) then to South America (which rejects the former view of Gondwanic origin). (3) During late Oligocene to early Miocene, when the Amazon drained west through a Western Andean Portal, radiation took place in what is now the northern Andes and Amazonia, while the southern Andean region was out of reach. (4) From the mid-Miocene the Andes was connected as a continuous dispersal avenue, but at the same time it was isolated from the eastern Amazonian lowlands by marine incursions from the north and enormous wetlands. (5) Finally, when the present Amazonian drainage pattern to the Atlantic was established in the upper Miocene, there was a strong flora exchange throughout the tropical South American lowlands. Altogether, the study reveals a clear sequence of events of dispersal and diversification in distinct areas.

The analytic approach has been used also in two recent studies of transoceanic dispersal in birds, and we must expect many further examples to follow.


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Edited by Camilla Fløjgaard
Dispersal processes may be critical in determining rates of species range shifts under future climate change. Travis Marsico, Jessica Hellman and Jeanne Romero-Severson, writing in the Journal of Biogeography, shed new light on the future by examining the past shifts in Oregon oak since the Last Glacial Maximum (LGM) (Marsico et al. 2009). They find that it doesn’t take a village, it just takes a single tree. This helps support an emerging new view of how plant range shifts are realized when climate shifts rapidly.

Until recently, prevailing concepts of biological response to rapid warming in North America and Europe were of large, monolithic range shifts in which species totally vacated habitat of waning suitability, moving to new, completely disjunct range. This view began to change in 1995 when Matt McGlone and Vera Markgraf presented a starkly contrasting model of vegetation shift in the Southern Hemisphere. In New Zealand, McGlone found recolonization of the South Island to be much more rapid than could be accounted for by long-distance dispersal (McGlone 1995). In southern South America, Markgraf documented vegetation change keeping pace with extremely rapid climate ‘flickers’ (Markgraf and Kenny 1995). Both authors suggested that micropockets of vegetation could explain the very rapid observed changes in dominant vegetation. Such micropockets of vegetation were very plausible in these southern settings where no large continental ice sheets existed.

Evidence has since grown that micropockets may be important in Northern Hemisphere settings as well (recent literature is briefly reviewed by Marsico et al.). Tree remains very close to the boundary of the ice sheet have been found in palerecords of both Europe and North America. Pollen signatures that were previously assumed to be from long-distance blow-in are now being reinterpreted as possible evidence of vegetation micropockets.

If the growing consensus around micropockets is correct, the implications for vegetation response to future, human-induced climate change is profound. Patches of vegetation of a few tens of meters on a side might provide source material at rapidly expanding range margins. Long-distance dispersal might establish micropockets of vegetation that would serve as stepping-stones for additional long-distance dispersal.

Marsico et al. show that in Oaks in the Pacific Northwest, dispersal was primarily from individuals on the leading edge of the range. Chloroplast DNA markers were remarkably homogenous in their samples. At 16 of 22 sites all individuals sampled shared a single chloroplast haplotype. Having identical chloroplast haplotype indicates a common maternal ancestor, so these populations were established from single colonizations or multiple colonizations by seeds from the same tree (which seems much less likely).

The implication is that single trees are critical for establishing populations in newly suitable range. Micropockets of vegetation would have ample sources of seeds for range shifts, if all it takes is a single tree. Marsico et al. found much more diversity in nuclear DNA, indicating that once single colonizations occur, populations grow and are diversified by wide pollen flow from many individuals. Colonists from micropockets and diversity from broader populations may be a key mechanism in rapid range shifts as rapid human-induced climate change gathers force.


Investigating the fauna of Malesia, the insular region between Indochina and Australia, has a long history in biogeography. In relating the distribution of animals to geographic settings of the present and the past, A.R. Wallace (1869) has not only defined our discipline but also provided data and ideas that substantially aided understanding organic evolution (e.g., Davies 2008). Given the depth of investigation of the Malesian region by Wallace and subsequent researchers until today (see references in Woodruff and Turner 2009), it is surprising that the delineation of the region towards the north-west, i.e. between ‘Sundaland’ and the Indochinese continental region, and the causes for this faunal transition, remained out of focus for so long.

In their recent article, Woodruff and Turner (2009) have used data on mammal distributions to investigate the faunal transition between continental Southeast Asia and the Thai-Malay peninsula (Fig. 1), building upon earlier analyses of the group (e.g. Woodruff 2003, Hughes et al. 2003). Woodruff and Turner show that there is not, in contradiction to common presumption and earlier results (e.g., Cranbrook 1981, Hughes et al. 2003, de Bruyn et al. 2005), a well-defined Indochinese-Sundaic faunal boundary, but rather a ca. 800 km gap between a southern fauna of the Malay peninsula (south of 5ºN) and the continental fauna (north of 14ºN). In this region species richness is reduced, and even many widespread species have gaps in their distributions. The authors discuss sea level changes as an agent that may explain this pattern. In the following I will first appraise two methodological and conceptual features – namely, ‘simplistically’ relying on raw distributional data, and the consideration of ancient shorelines during times when sea levels were higher than today. I will then raise the issue of historical versus environmental explanations in biogeography, in relation to Woodruff and Turner’s fine work.

Woodruff and Turner relied on actual presence records to analyze the limits of species’ distribution. The nature of their study region, with a clear north-south orientation, allowed using latitudinal range limits as a simple measure of distribution. For all but the best-sampled regions and taxa of Europe and North America, such data are surely biased by undersampling – species may occur well outside recorded limits, but have not yet been found. A large number of methods, ranging from more or less clearly defined ‘expert range assessments’ to numerical models of species’ ecological niches (e.g., Elith et al. 2006), have been proposed to correct for such biases. However, such estimates of ‘true’ ranges are unable, at present, to account for the effects of dispersal barriers or local extinctions (e.g., Munguía et al. 2008), but require a priori assumptions on distributional limits caused by historical factors. Any gain by correcting for undersampling would therefore be punished by an increased circularity of arguments when the aim is to define historically caused boundaries of distribution. Decisions on using range estimates or raw data must be weighted in light of the investigated system (i.e., degree of undersampling) and the questions asked, and in Woodruff and Turner’s study this is clearly in favour of the ‘old-
fashioned’ raw data approach taken by the authors. However, for good reasons the authors did not analyze east-west distribution patterns of species within Indochina, as massive undersampling in places like Burma, Laos or Vietnam would make most raw longitudinal data highly unreliable (but see Catullo et al. 2008 for an attempt to provide and use estimate data).

In their attempt to explain the latitudinal faunal patterns found, Woodruff and Turner turn to the fluctuations of sea levels (using latest geological data) and their implications on fusing and disrupting land areas over time. Many researches have tried to explain complex faunal patterns across the islands between Southeast Asia and Australia by changed shorelines during periods of lowered sea levels, when parts of the continental shelves fell dry and facilitated faunal exchange. However, the present study points out the potential importance of higher sea levels in causing local extinctions and distributions gaps that persist until today. These may have often been overlooked in earlier biogeographic studies in the region (cf. Woodruff 2003). Furthermore, they argue that the repetition and rapidity of change, rather than the creation of water straits as dispersal barriers, may have played a prominent role here. Their argument can be condensed to sea-level dependent contractions in available area sizes that led to regional extinctions within a once more widespread fauna. A concentration of faunal boundaries would then be expected where stable habitat, i.e. mountainous regions, is bordering the regularly flooded zones – and this is what has been found.

Woodruff and Turner thoroughly discussed how additional processes could have affected species’ geographic distributions in the region, and how future studies could support and test their proposed historical explanation. Of those, I want to focus here on the consideration of species’ ecological niches, hence the importance of habitat conditions. How much of the observed pattern could actually be explained by present-day environmental differences between regions, rather than by historical idiosyncrasies? For example, Beck et al. (2007) observed a similar pattern of reduced species richness in the central peninsula in moths as Woodruff and Turner for mammals, but discussed present-day factors (lack of montane and near-natural habitats, present-day area), rather than historical accounts of sea level changes, as potential explanations. Irrespectively of the fact that Woodruff and Turner’s study is based on much better data, and Beck et al. (2007) were simply unaware of the details of shoreline changes due to sea levels in the region, we should ask ourselves which kind of explanation should have precedence over the other in biogeography, and why.

Biogeography is currently divided in a historical branch and a (macro-)ecological branch, with the former investigating idiosyncratic events (in time and space) while the latter is dominated by the statistical search for stable patterns (of, e.g., environmental effects) as a consequence of, implicitly, equilibrium processes. It is far from trivial to judge what kind of explanation for observed patterns is more relevant. Recently, Ricklefs (2006; see also Ricklefs 2004) has argued convinc-
ingly that biodiversity is structured top-down from the regional (i.e., historical) to the local, whereas many ecologists implicitly seem to take the opposite approach. There is a growing trend to attempt fusing and weighting such historical and environmental explanations against each other (e.g., Graham et al. 2006; Hortal et al. 2008), of which biogeography will surely profit. Solving this problem is important, because biogeography is likely to transform from a ‘ivory tower’ academic discipline to one that is expected to predict, mitigate and reverse environmental problems related to ‘global change’. Understanding the relative importance of environmental determinism and historical idiosyncrasy will be a key factor in achieving this: We can affect, in theory, the former by ‘ecosystem management’, while we can’t turn back time on historical events.

References


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Modern global climate change can affect species in natural communities in a variety of ways. One outcome that has received broad attention within the biogeographical community is species’ range shifts. There is growing empirical evidence for shifts that, in the majority of cases, follow climate change expectations with species moving to higher latitudes or to higher elevations (Parmesan 2006). With the growing appreciation that species are indeed responding to climate change, there has been an expanding modeling effort to project the long-term geographical consequences. Specifically, workers have developed models that use species’ climatic niches (or envelopes) within their current geographic range to forecast species’ distributions under future climate-change scenarios (Pearson & Dawson 2003).

When birds are considered in these investigations, shifts in breeding ranges in northern temperate-regions are often examined with little attention given to winter ranges in equatorial regions or the consequences of range shifts for migratory routes and strategies. In many cases, this is due to simple data limitations: the most thorough occurrence information for birds is typically confined to breeding and non-breeding ranges in Europe and North America. Migration under climate change has been an important topic of investigation (Parmesan 2007); however, most analyses address questions related to phenology where data tends to be more prevalent. In a recent article in the *Journal of Biogeography* (Doswald et al. 2009), Nathalie Doswald and colleagues applied climate envelope models to both the breeding and non-breeding ranges of 17 European *Sylvia* warblers, a group of birds that are common residents and visitors to Europe. Doswald et al. (2009) extends the findings of earlier investigations (e.g., Huntley et al. 2006) by quantifying the geographical consequences of climate change for migratory species, thus expanding the predictive breadth of recent modeling endeavors and also our appreciation of the many challenges birds and other taxa will likely face under climate change.

Migration is a common strategy for birds. To have enough energy to undertake long journeys, birds must build large quantities of fat reserves. If climate change results in greater migration distances, the viability of this phenomenon could be seriously challenged. Doswald et al. (2009) found that the majority of breeding ranges for the 17 *Sylvia* species were projected to shift northwards, but there was no evidence for a consistent directional shift with winter ranges. Thus, potential changes in migratory distances were, in most cases, a consequence of shifts in breeding ranges rather than winter ranges. Assuming species retain both breeding and non-breeding ranges and all individuals migrate in a similar fashion, migration distances were estimated to increase by an average of 413 km for trans-Saharan migrants and 201 km for resident and short-distance or partial migrants. Assuming increases in fuel requirements for longer migrations can be physiologically accommodated, these species are likely to require more time for feeding or richer food resources prior and during migration to achieve these longer distances. Alternatively, migration behavior might diminish to the point where separate breeding and non-breeding ranges are no longer a necessity, particular for short-distance or partial migrants whose breeding and non-breeding ranges are located at higher latitudes.

An additional pattern examined by Doswald et al. (2009) was the degree of range overlap between the current and projected breeding and non-breeding ranges. These values were found to be highly variable among species with an overlap of 33% and 36% on average for breeding and non-breeding ranges, respectively. Regions of overlap can be seen as important transition zones, allowing populations to persist within their historical ranges, thus providing valuable time for species to respond to changing climatic conditions. They also
found that the degree of overlap was correlated with range size, thus range-shift gaps (sensu Colwell et al. 2008) are more likely for species with narrow distributions. In addition, range size has been found to be strongly correlated with dispersal ability in *Sylvia* warblers (Böhning-Gaese et al. 2006). In total, current evidence suggests migratory birds with widespread ranges are in a better position geographically to respond to climate change.

Doswald et al. (2009) expands the application of climate envelope models by quantifying the potential affects of climate change on migration strategies. If the projected increases cannot be bridged for long-distance migrants due to physiological or other limitations or if the climatic niche associated with the breeding or non-breeding ranges no longer exists (Williams et al. 2007), new migration strategies will have to be developed, in many cases quite rapidly, for these species to persist. When considered under the context of other pressures that these species are likely to face, particularly from land-use change within their breeding and non-breeding ranges (Jetz et al. 2007), long-distance migrants are at particular threat of population decline and extinction.

Climate envelope models remain problematic with many untested assumptions (Pearson & Dawson 2003). However, evidence for accelerating climate change (Beaumont et al. 2008) hastens the need to build and apply models that can generate predictions that are geographically accurate and ecologically comprehensive. Migration strategy is one of the many biological factors that need to be incorporated into these models before we will have a truly robust and defensible representation of the consequences of climate change for biodiversity. Until then, we are likely to remain passive observers not grasping the full biological implications of climate change until they have been fully manifested.

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Biological invasions are a current conundrum for the management of worldwide biodiversity. International transportation networks have facilitated the connection of distant regions, and eased the movement of exotic species historically confined to their native areas by natural barriers and dispersal constraints. Some of these species have the capacity to establish and spread successfully in newly occupied biogeographic regions, becoming a real problem for the hosting ecosystems and the humans that depend on them. They compete with native species and alter the functioning of ecosystems, threatening the services provided by these ecosystems and in some cases having direct effects on human health.

The management of biological invasions and/or ecosystems hosting them is becoming ever more relevant, as the number of exotic plant and animal species increases worldwide. Management actions range from preventive measures to avoid the introduction of exotic species, to control operations of entire ecosystems after establishment of invasive organisms. To facilitate the management of these novel ecosystems (sensu Hobbs et al. 2006), it is necessary to expose and develop appropriate data on the ecology and distribution of invasive species, as well as tools to assist in prioritizing actions for control of alien plants. In this vein, two papers have been published recently that shed some light into these issues.

The first study was conducted by several plant ecologists from Europe, and has been published in *Diversity and Distributions* under the leadership of Milan Chytrý from the Masaryk University (Czech Republic). Chytrý et al. (2009) provide the first spatially explicit quantification of the level of alien plant invasion at a regional level for Europe. Combining quantitative data on the proportion of alien species that invade different habitat types with a land-cover map, they produced a map that estimates the levels of invasion across Europe. Their utilization of habitats as a basis for mapping levels of invasion was justified by a previous study (Chytrý et al, 2008), in which habitat types were shown to be better predictions of invasion levels than other variables, such as environmental characteristics or propagule pressure.

Their results predict that the highest levels of alien plant invasions occur among arable land, urban and industrial areas, whereas the lowest levels occur in sclerophyllous vegetation, peat-bogs and heathlands. The spatial distribution of the level of invasion suggests that the highest levels of invasion are in lowland areas of western Europe and in agricultural regions in central and eastern Europe. In contrast, low levels are predicted in boreal regions and mountainous zones, except along coastlines, irrigated agricultural land, and rivers of the Mediterranean region. Even though the approach used to elaborate the map is coarse and although there is potential for further improvements, this study provides a first look at the level of plant invasion in Europe and permits the identification of areas susceptible to donate/receive exotic species.

In parallel with this study mapping levels of invasion, Andrew J. Tatem from the University of Florida (USA) examined the potential dispersal of exotic species in a new study published in *Ecography*. Tatem (2009) provides a framework to predict biological invasion risks through the worldwide airline network, and assesses future changes due to human and environmental variations. The growth of air travel increases the propagule pressure and rate of exotic species introductions, but the establishment of such organisms in new regions will depend upon whether they find climatic conditions similar to those at their origin. Build upon a previous study (Tatem and Hay 2007), he examines the spatial and seasonal distribution of incoming traffic volume to individual airports, and combines this information with climate scenarios for the period 2007-2010 to identify potential invasion risk routes.

His results suggest that changes in global climate will be relatively small during the near future, but increases in incoming traffic from China, India, Russia and eastern Europe are expected to
provide more opportunities for the importation of exotic species. The convergence of air routes from these growing economies to other climatically similar regions depends, however, on the time of the year of transport. The model predicts that climatically sensitive organisms travelling by air will find their destination airports most hospitable by June 2010. This study provides a first assessment of the transportation risk associated with air travel, and permits the scheduling of surveillance priorities in both space and time for preventing the entrance of exotic species.

Quantifying the levels of invasion and the potential invasion routes enables the identification of areas at risk of invasion, and therefore allows for targeted surveillance and control actions to prevent the movement and establishment of exotic species. The optimization of control operations is necessary to allocate the limited number of resources available in the most appropriate way, and assure the efficiency of surveillance systems in reducing the introduction and establishment of exotic species.

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more popular visual media (TV) are considered worse transgressors than the embattled print media (Pew-AAAS 2009).

Randy Olson’s book, “Don’t be such a scientist – talking substance in an age of style”, is thus a wonderfully timed resource. In an amusing and light read (it took me only 3 connecting flights from Chicago, Illinois, to Merced, California, plus the usual several hours delay with United Airlines, to complete the book), Olson explains why scientists are unhappy with the media (particularly visual media), why the media doesn’t represent our interests well, and why the public don’t seem to mind. What it comes down to, he suggests, is that whereas scientists focus intensely on detail, the media needs to arouse interest (usually quickly) and the general audience is engaged by a small subset of simple storylines without too much complexity. Bridging this gap, and halting the slide of science’s standing, is the burden that falls to communicators of science, who increasingly are scientists (Anon 2009).

Olson structures the book around four general rules for better communication, gleaned from his years in Hollywood. The first chapter, Don’t Be So Cerebral, explains that while scientists typically engage intellectually with the logic and probability of events, most people connect through their ‘hearts’ (passion, heartfelt sincerity), ‘gut’ (belly-laughs, revulsion, intuition [gut-feeling], impulse), and ‘gonads’ (sex). Of course, all those trained in anatomy and physiology know these feelings are essentially in the brain, but, hey, don’t be so cerebral and literal-minded!

Not by coincidence, the second chapter, Don’t Be So Literal Minded, emphasizes that people get and remember examples that aren’t boring and direct; would the Blackberry be as hip and successful if it had retained it’s prototype name “PocketLink”? Would Olson’s Shifting Baselines project (www.shiftingbaselines.org) have been as long-lasting if it had been called “The Oceans Are in Trouble”? His answer is ‘no’ because that name wouldn’t distinguish it from other similarly or unimaginatively named projects (such as the short-lived “Less Than One” campaign). In contrast, Blackberry and Shifting Baselines are easy to remember and initially intriguing, leaving people with the ability and desire to find out more after hearing only scant details and the name; it’s like a whodunit.

This approach to engagement, or in Olson’s terms “arousal” that generates a desire in the audience to find fulfilment, is the first part of storytelling, and he encourages each of us Don’t Be Such a Poor Storyteller. Fortunately, in this respect, he argues we already have a foot in the door. A scientific paper approximates the classic formula of a three-act story: Act One, the introduction, sets the scene and raises a question; Act Two, the methods and results, provides details and allows the audience to guess for themselves what is happening; Act Three, the conclusion, places the evidence in the setting and, for the most part, finishes by satisfactorily answering the question raised at the end of Act One. Olson claims this arc of a captivating story is so simple that one can understand the principle plot of most major movies without any dialogue.

The fourth, and final piece of advice, Don’t Be So Unlikeable, is perhaps the most important and hardest to overcome. The modern scientific method is built on the Popperian foundation of falsification. Thus, scientists become, after years of training, very comfortable with criticism, negativity, raising ideas and having them knocked down. This is how science advances. Unfortunately, this counter-intuitive approach to the creative process, and those who practice it, can be easily misinterpreted as the destroyers of dreams that suck dry life and leave only the ashes and bones of a once beautiful idea.

Don’t Be Such A Scientist encourages us to have greater empathy with the general public, to understand their needs, wants, and desires, and to tell them stories about the wonder of science to which they can relate. In doing so, they will also be stimulated to learn more for themselves. Notably, this is how scientists learn science. Olson does not advocate fabricating stories, but does promote practicing a more acceptable voice; encouraging and enabling people to know more while not making obvious what they don’t know yet. “This is the burden that science communicators...
“face” and Olson suggests through many examples that it won’t be easy to overcome. It took him 15 years to become “scientist-turned-filmmaker”, one-third of students think the Scripps Institution of Oceanography communications workshops in which he participates are “a total waste of time”, and popularisers of science are commonly perceived as weaker scientists. But without better communication, science may slip further in the public’s perception, scientists may be perceived less favourably, and research may become harder to fund publicly (as is currently the case in California).

These issues already concern us as biogeographers. The divide between the public’s and the scientists’ perceptions is great on issues within our purview. Less than a third of the US public considers evolution a fact (cf. 87% of scientists), only 49% believe the Earth’s climate is warming (cf. 84% of scientists), and people who hold these scientifically unsupported views, i.e. the majority, have lower opinions of scientists (Pew-AAAS 2009). In contrast, majorities favor health issues such as vaccination (69%) and even controversial embryonic stem cell research (58%; Pew-AAAS 2009). Biogeographers have a great burden to lift. Yet, a majority of scientists (97%) and public (76%) support involvement of scientists in debates about science and, for the most part scientists are not considered politically biased by the public (64%; Pew-AAAS 2009). The public want us to communicate, the scientific establishment is encouraging us to communicate (e.g. NSF 2008; EU 2007), and Olson has provided us with a few tips on how to do it successfully. If you’re not convinced he’s got something useful to say, then next time you’re on a plane, try turning on the movie, turning off the sound, and spending 5% of your time watching the movie and 95% of your time reading this book; you’ll understand the plot and outcome of the movie and might not even care you missed the details in the dialogue – Q.E.D.

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Remember that being a member of IBS you can get free online access to four biogeography journals: *Journal of Biogeography*, *Ecography*, *Global Ecology and Biogeography* and *Diversity and Distributions*. You can also obtain a 20% discount on the journals *Oikos* and *Journal of Avian Biology*.

Additional information is available at [http://www.biogeography.org/](http://www.biogeography.org/).
The islands of Melanesia (New Guinea, The Solomon Islands, Vanuatu, Fiji and New Caledonia) present a unique challenge to biogeographers. They possess a recondite geologic history where ancient and modern forces interact to create enigmatic patterns of species diversity. Melanesia has served as the laboratory from which some of the greatest works of biogeography have been launched, including seminal works on the biological species concept (Mayr 1947), the island biogeography (MacArthur and Wilson 1963) and island speciation (Diamond 1974).

Despite the importance of Melanesia, there is a lack of knowledge pertaining to the large-scale, multi-taxa biogeographic trends in the region. The lack of work on concordant biogeography is regrettable, as it has hamstrung the development of a synthetic approach towards biogeographic research, and its corollary identification of conservation management units. For example, although a recent biogeographic study of a multi-taxon patterns of marine biodiversity (Roberts et al. 2002) has invigorated research into the processes underlying its evolution (Barber & Bellwood 2005; Carpenter & Springer 2005; De Boer et al. 2008) none of these papers have incorporated salient work from the ornithological (Filardi & Moyle 2005; Mayr & Diamond 2001) or entomological (Wilson 1959) literature (although see Drew et al. 2008).

To address these shortcomings we convened a workshop entitled “A Multi-Taxa Approach Towards the Biogeography of Melanesia: Higher Order Science to Inform Conservation” in August 2009 in Suva, Fiji. This workshop, funded by the Biodiversity Synthesis Center, a component of the Encyclopedia of Life housed at the Field Museum of Natural History (http://synthesis.eol.org/), brought together researchers who focus on a variety of taxa, ranging from vascular plants to coral reef fish. The goal was to identify what patterns of distribution are recapitulated across taxonomic boundaries, and what biological differences are key to influencing the geographic distribution of life.

The majority of these researchers showed a pattern of decreasing species diversity and endemism as one moves away from the center of diversity in Papua New Guinea. This generality of this pattern was difficult to assess because of variances in sampling effort. In particular Fiji, which has been relatively better studied appeared to have more species of ants and flies than the Solomons, however with further research within the Solomons this pattern is most likely to be reversed. Another relatively common pattern was that in no areas had species discovery curves reached saturation. In short, despite 150 years of serious collections based research in the region, we have not yet adequately characterized the diversity of life in Melanesia.

Another common theme throughout the meeting was the need to encourage stronger relationships between local students and international researchers. As in many places, working within the local culture can vastly improve a research project’s success and increase awareness of the area’s biodiversity. Given the complex tapestry of national and local and traditional governments, the prevalence of place based communal property rights and management and the intricacies of marine tenure, working without local expertise bound to hinder research projects. On the other hand, many regional students are hindered by lack of formal expertise, mentorships and access to research materials. There is clearly an opportunity for win-win partnerships for biodiversity research to be developed within this region.

Finally, with the generous support of the International Biogeography Society, we were able
to take a first step towards integrating local students into the international research environment by providing them free memberships into the society. In areas where journal access is often prohibitively expensive, the on-line access to the four journals will allow these students the ability to see the diversity of research being carried out by their new colleagues. We are also developing a bibliography of Melanesian biogeography containing approximately 150 abstracts and reprints covering the range of critical papers in the region.

The workshop also took aim at integrating the academic findings into a broader management and conservation context. With representatives from both government agencies and non-government organizations participating the workshop provided a unique opportunity for those who produce knowledge to meet with those who apply that knowledge. Several topics were presented including a lively discussions on “open ended taxa” (Bickel 2009) and the role of community based conservation projects (Aswani 2006).

This workshop provided the opportunity for scientists coming from diverse taxonomic backgrounds to discuss some of the major patterns of species distribution. It provided an opportunity for scientists and managers to work hand in hand to find unique and innovative ways to protect biodiversity within the islands of Melanesia. We have much to learn about the biogeography of the region, however this workshop identified several concrete next steps towards elucidating those patterns.

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Your pictures can be the cover of the next *Frontiers of Biogeography* issue. If you have photos or artwork related to biogeography that could make a great cover send them to ibs@mncn.csic.es or frontiersofbiogeography@gmail.com. The best pictures received will be the cover of forthcoming issues (in the case of pictures in landscape layout, an excerpt will be used). We will also consider pictures for the inside of the journal.
The concepts of equilibrium and stability in biogeography are perhaps much more fleeting than has generally been appreciated, and disequilibrium may actually rule the situation in most cases (Manning et al. 2009). That is, although researchers may discuss current distributional patterns as fixed, those patterns may have been in place only for a relatively short period of time (~10^4 yr), perhaps since the last major global cool period at the end of the Pleistocene (Figure 1). Although Pleistocene climatic fluctuations have been considered a major force in biogeography, and some have argued that they may have produced much of current species diversity (Mengel 1970, Haffer 1997), the validity of the Pleistocene speciation paradigm has been debated hotly recently—see, e.g., Klicka and Zink (1997) versus Weir and Schluter (2004).

“The Pleistocene” is often cited as a biogeographic force, but too often uncritically and without full consideration of the complexity of world climates over the past million years. That is, molecular systematists frequently use molecular “clocks” that date splitting events imprecisely, usually with confidence intervals so broad as to inspire concern (Peterson 2007); these studies often refer to Pleistocene climatic fluctuations, but with no specifics, although the ability to date splitting events may improve with broader use of population-genetic approaches to the challenge (Arbogast et al. 2002). This general appreciation of the role of Pleistocene climatic fluctuations as important biogeographically nonetheless has not to date translated into detailed analyses of key events structuring biogeographic patterns in many phylogeographic analyses.

In particular, the Pleistocene was characterized by a complex series of warm periods (similar to present-day climates) and cold periods (“ice ages”), with impressively short transitions in between (Figure 2; Dansgaard et al. 1993). Although considerable attention has focused on the last of the glacial maxima (~21,000 yr before present), in reality, all of these alternating periods of warm and cold climates probably had some influence on present patterns of diversity and distribution of biodiversity (Svenning and Skov 2004). The purpose of this commentary is to reflect on likely effects of such repeated and dramatic global climate fluctuations in shaping patterns of distribution of species, and to emphasize the need for broader

**Figure 1.** Temperature and precipitation fluctuations over the past 135,000 yr: shown are annual mean temperature profiles (all on the same scale) for the present day, Last Glacial Maximum (21,000 yr ago; CCSM scenario), and Last Interglacial (135,000 yr ago; Otto-Bliesner et al. 2006). The 10 shading classes cover equal intervals between -50° and +31.5°C.
analyses aimed at clarifying the roles of these effects in biogeographic studies.

Why are species where they are? The BAM diagram
Soberón and Peterson (2005) presented a framework for understanding geographic distributions of species that considers autecology, synecology, and geography (Figure 3). That is, following the earlier framework of Hutchinson (1978), they envisioned the broad, climatically determined abiotic (“fundamental”) niche as being reduced to some degree by biotic interactions necessary for the species’ persistence in a region to create a “realized” niche that emphasizes the role of negative interactions in reducing species’ ecological potential. However, Hutchinson (1978) neglected effects of geographic heterogeneity and subdivision and limited dispersal, and as such missed quite a bit of complexity that has been the focus of historical biogeography. The Soberón and Peterson (2005) framework thus included considerations of movement and access as a further constraint on the distributional potential of species. This combination of aspects of Biotic interactions, Abiotic conditions, and Movement (hence “BAM”) outlines major factors affecting the distributional potential of species.

The basic BAM configuration (Figure 3), however, is not necessarily representative of particular cases. Rather, other BAM configurations are possible (Figure 4): these configurations likely correspond to the mental pictures that different suites of researchers may have regarding species’ distributions. For example, the classic “community ecology” viewpoint (similar to Hutchinson’s ideas) would paint M as broad, but A ∩ B as quite restrictive, thus emphasizing the role of interactions among species in determining species’ geographic potential. The biogeographer, on the other hand, imagines that A ∩ B ≈ A; under this view, biotic interactions may not affect abiotic potential dramatically (at least at coarse-grained resolutions; Soberón 2007), and rather a restrictive M determines the key features of species’ distributions—note that this configuration coincides with recent trends towards downplaying the role of local biotic interactions in structuring ecological communities (e.g., Ricklefs 2008). Although the degree to which the community ecologists or the biogeographers are correct across major swaths of biological diversity has not been resolved, and must remain a topic for future research, these viewpoints probably represent extremes of the set of likely possibilities.

The critical role of M
The above discussion of the BAM diagram points toward a key role of dispersal limitation in shaping species’ geographic distributions. In particular, M is determined by some combination of present-day dispersal ability (e.g., capacity for movement between natal and reproductive sites), and historical range shifts that opened access to areas relatively more remote from present-day distribu-
Phylogeography is not enough: The need for multiple lines of evidence

Figure 3. The “BAM diagram,” showing a simplified framework for understanding where species will and will not be distributed. Distributions of species are seen as responding to three sets of factors: the abiotic niche (A, in red) and the biotic niche (B, in gray), which roughly correspond to the fundamental ecological niche (A) and the realized ecological niche (A ∩ B, here termed the potential distribution) of Hutchinson (1978). A further modification to distributional potential, however, is that of accessibility (here M for “movement,” in blue), which may constrain species’ distributions dramatically. Reproduced from Soberón and Peterson (2005).

Figure 4. Different configurations of the BAM framework that emphasize different factors. Left side: abiotic and biotic considerations overlap broadly, permitting neglect of biotic effects in reducing abiotic potential, but accessibility is constrained, perhaps owing to a highly subdivided biogeographic landscape. Right side: accessibility is quite broad, but abiotic and biotic conditions necessary for survival are very restrictive, indicating a situation in which biotic interactions modify abiotic potential substantially.
tional areas (Soberón and Peterson 2005). The importance of the latter phenomenon is evidenced by the frequency of relictual isolated populations in many parts of the world (e.g., Smith et al. 2000).

In the context of this commentary, historical components of $\mathbf{M}$ frequently have been imposed by “hard” barriers (i.e., barriers that do not shift with changing climatic conditions), including shorelines, large rivers, mountain ranges, deep valleys, and other topographic features. These features, at least in general, have remained largely fixed even as major climatic shifts have occurred, for example over the past million years, with the Pleistocene glaciation events. To the extent that species were unable to disperse across such barriers, the availability of particular climatic conditions in particular biogeographic regions may be restricted dramatically during certain climatic events (see, e.g., Figure 5). These dynamics may have dominant influences on which species are able to survive, and in what numbers, in a particular area.

**Pleistocene climatic fluctuations**

The influence of the dramatic Pleistocene climatic fluctuations on distributions of species needs to be considered in the framework just presented. That is, given the constraints of $\mathbf{M}$, a species should persist only in areas that are simultaneously suitable environmentally and accessible over the long-term integration of these climate-change processes. One can imagine the spatial representation of a particular species’ niche in a region defined by hard barriers through time—if that representation becomes too fragmented or too reduced, then the species will not be likely to persist there.

A further constraint is that of distributional disequilibrium within $\mathbf{M}$ (Svenning and Skov 2004, 2007). That is, Pleistocene climatic fluctuations likely frequently produced spatial shifts in habitable areas within areas delimited by hard barriers. To survive a period of change, the species must have dispersal abilities sufficient to track the habitable areas sufficiently quickly such that it is not left behind (Holt 1990), without being able to reach habitable area even within the region defined by the hard barriers. That is, even if the hard-barrier-defined region retains suitable areas, the species must nonetheless be able to track those suitable areas as they shift to be able to survive in the area in the long term.

If conditions change very rapidly, as might have been the case in the Pleistocene (Figure 2), spatial shifts of suitable areas may overcome the dispersal and colonization abilities of the species. In this case, species may be able to persist only via refugial populations in specific areas remaining habitable in the region through climate changes. That is, when climate change is extremely rapid,
species’ dispersal abilities may not allow tracking the shifts in suitable areas, but persistence may be possible in areas of overlap between warm- and cold-condition suitable areas. These refugial areas may thus provide the key to persistence when conditions change particularly rapidly.

Beyond phylogeography

The discussions above point out that persistence of species in regions characterized by hard barriers is a delicate and constrained phenomenon when climates change dramatically. This situation was manifested particularly frequently in the Pleistocene, when global climates switched between warm and cold climate conditions rapidly at many points. This dynamic likely affected major portions of global biodiversity during much of the last million years of Earth history.

Phylogeography at its roots is a cross-linking field, intended to touch multiple fields and multiple suites of tools (Avise 2000), and some phylogeographic research has indeed reached out in more diverse directions. The scenarios of rapid change and perpetual disequilibrium discussed herein suggest, however, that common practice phylogeographic and molecular ecology approaches to biogeography will frequently prove inadequate to capture the details of the biogeographic history of lineages. Imprecise dating of key splitting events means that typical phylogeographic approaches will come up short in explaining Pleistocene biogeography, referring only indefinitely to time spans that cover multiple warm or cold periods. They will paint a general picture that too frequently consists of generalities only, and cannot anticipate the fine details.

In addition, phylogeographic approaches have no means by which to address the “where” of biogeographic events. Phylogeographic breaks have a known position at present, but that position may or may not correspond to the position of the break, or the geographic feature that caused it, in the past. Coalescent approaches may indicate population expansion or relictual distributions, but cannot inform as to where those populations were located when they were large or small.

Multiple lines of evidence will be necessary to clarify this situation, i.e., phylogeography needs company in meeting the challenge of understanding the past geography of biodiversity. The field that could be termed “species-level quantitative distributional ecology”—often referred to as ecological niche modeling—offers an opportunity here (Soberón and Peterson 2004). That is, niche models trained and validated under present-day conditions can be projected onto past conditions corresponding to specific points in the past—currently, paleoecological scenarios are available for 6000, 21,000, and 135,000 yr before present (Hijmans et al. 2005a, b). Hindcasting (i.e., retro-projections of present-day niche models) permits development of explicit paleodistributional scenarios to which phylogeographic patterns can be compared via coalescent simulations, potentially permitting testing explicit hypotheses of causation by particular climatic events. What is more, the explicit geographic hypotheses that are developed provide the potential for estimates of ages of lineages independent of the imprecise clock-based estimates customarily employed.

Studies to date have confirmed ecological niche conservatism over the latter part of the Pleistocene (Martínez-Meyer et al. 2004, Martínez-Meyer and Peterson 2006, Banks et al. 2008), and have indicated significant predictive ability of paleodistributional predictions of niche models regarding phylogeographic patterns (Peterson and Nyári 2007, Waltari et al. 2007, Waltari and Guralnick 2009). Niche modeling approaches, however, still have many hurdles to overcome: for example, serious conceptual and methodological issues remain in the realms of niche estimation (Soberón 2007), model interpretation and thresholding (Pearson et al. 2007), and model validation (Lobo et al. 2008, Peterson et al. 2008). Even more importantly, the challenges of transferring niche models among very different environmental landscapes (e.g., from present-day to Last Glacial Maximum) are only beginning to be explored—complications include the coarse grain of present-day paleoclimatic data sets, error and inaccuracy in those same data sets, and the question of how conservative are ecological niches.
through evolutionary time, so many important lessons remain. An important specific step will be development of multiple paleodistributional hypotheses corresponding to different time periods, with quantitative comparisons of their explanatory abilities regarding different “slices” of the evolutionary history of the group (Carstens and Richards 2007, Knowles et al. 2007).

More generally, the availability of powerful, quantitative tools in phylogeography and biogeography should be an impetus towards greater rigor in the field. That is, molecular approaches provide fascinating views into the population genetic past of lineages; their results, however, are limited for lack of spatially explicit inferences, so other sources of information are needed. Ecological niche modeling and their projections onto paleoclimatic scenarios offer one important means of enriching these views into the past. These multiple lines of evidence will provide a much richer view of biogeographic history, as has become evident from the success of first steps in this direction (Carstens et al. 2005, Cheddadi et al. 2006, Carstens and Richards 2007, Knowles et al. 2007, Peterson and Nyári 2007, Alsos et al. 2009, Walti and Guralnick 2009).

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Edited by Joaquín Hortal

New Book: Systematics, Evolution & Biogeography of Compositae
V. A. Funk., A. Susanna, T. Stuessy & R. Bayer (eds)

The Compositae are the largest family of flowering plants with ca. 25,000 species. Until recently the classification has remained largely unchanged since the 1800’s. This volume is based on the latest phylogeny for the family and each clade is examined by the experts (morphological & molecular). Nearly every group is based on a color coded biogeographic tree and the concluding chapter shows the movement of the extant members around the globe. The book has 44 chapters, 80 authors, 1000 pages (200 in color) and is available for $110 at compositaebook@gmail.com. All proceeds go to the International Association for Plant Taxonomy (http://www.botanik.univie.ac.at/iapt/).
Relevance of biogeography to your work

Antje Ahrends: Is biogeography – “the study of the geography of life” – a relevant discipline to your work?

Neil Burgess: Yes, biogeography is relevant to my work. It is particularly important to my work for WWF. We devised a system of Ecoregions that are used to prioritise where WWF should focus conservation efforts at a global and at continental scales - Africa being the area where I work. This prioritisation scheme (called “Global 200”) identifies the most important areas for endemic species within major taxonomic groups - mammals, birds, reptiles, amphibians and other taxa. However, Global200 is not only driven by endemics but also considers ecological processes. African savannahs are a good example for that – they are not high in endemism but have the largest concentration of large mammals on earth, and some of the last remaining large mammal migrations. A conservation prioritisation scheme that does not include such ecological process values would leave out important areas. So yes, from a practical point of view biogeography is very relevant to my work as it defines the areas where WWF works on the ground.

AA: Do you think biogeography is relevant to practical conservation planning in general?

NB: Yes, biogeography, or rather conservation biogeography, is important to all conservation organisations, whether they are Conservation International, WWF or BirdLife International. All of these organisations developed their own conservation prioritisation scheme underpinned by biogeographic information, and in many regions these systems agree. These schemes have been developed at a global scale, but also at finer scales – for example the Congo Basin – people use biogeographic information in order to define where to work on the ground, which landscapes, ecological processes and species to conserve and how to design the protected area network. I think that the application of biogeographical data and some of the fundamental principals of that discipline becomes more tangible and relevant to practical conservation as you go down in scale.

AA: Do you read biogeographic journals, or otherwise receive information on new findings in the field of biogeography? What are your main sources for this?

NB: I do not read academic literature on a regular basis. However, working at a university I have access to biogeographic journals, and I read articles relevant to my work when I find out about them. I also published in and review for biogeographic journals, for example Diversity and Distributions. However, I don’t read these journals systemati-
cally as most published articles are not really relevant to my work. Form my point of view, it would be very useful if there was a way for scientific journals to automatically send the details of potentially interesting articles if they knew about one’s interests – in my case articles on conservation biogeography, Africa, and landscape and conservation planning. Regarding sources other than journals, I regularly go to Society for Conservation Biology meetings and attend conservation biogeography forums and symposia at that meeting, if there are any. I also find historical biogeography interesting (evolutionary biogeography and palaeo biogeography) as the pattern of ancient and newly evolved species has relevance to conservation planning. I would not go to pure biogeography meetings, unless they had sessions on conservation biogeography, purely through a lack of time in the working year.

AA: Do you collaborate with biogeographic research institutions?

NB: I collaborate to some extent with Carsten Rahbek and Jon Fjeldså from the University of Copenhagen and Peter Linder in Switzerland. We are trying to see whether we can use existing species distribution data to define ecological areas in Africa, i.e. to give the Ecoregions in Africa a more rigorous scientific basis. We are also interested in the patterns of genetic age of species to assess past and present evolution within major taxonomic groups – for example birds.

The general practicality of incorporating new biogeographic findings in conservation work

AA: Most species are difficult to monitor due to the lack of data. Do you believe that quantitative biogeographic methods (e.g. species distribution modelling) are useful to fill in these gaps, for example for the design of reserve networks or to establish the vulnerability of species to environmental change? Or do you think that given that these methods are inherently uncertain, it is difficult, if not risky, to allow them to guide conservation planning?

NB: At this point in time it remains primarily of academic interest to see how well species distributions can be modelled. If it can be proven that it can be done well, i.e. that it can tell you things that the original data did not show, and that it is reliable and affordable, it could become extremely useful for conservation planning. At the moment most of the species modelling work seems most useful at an indicative level - in that it gives you some new ideas on places that might be biologically important, but where you do not have field data. This prediction can then be tested on the ground. In my view, it would not yet be recommended to define a conservation plan for a country or region based on the outcomes of species distribution models.

AA: The nature of scientific research is to continuously challenge existing wisdom, and as a consequence there frequently is a lot of disagreement and a rapid-turnover in what is regarded state-of-the-art. For instance, a predictive model for species distributions praised a few years ago might already be regarded as flawed today! Does this scientific rationale make it difficult to include biogeographic findings in conservation practice given that conservation generally needs longer term strategies and commitments?

NB: It can make it difficult. If there is strong disagreement and all the leading scientists claim they are right, decision makers and those developing policy have a tendency to ignore the issue as being ‘too controversial’. The easiest thing is for them to assume that everybody is wrong. If on the other hand there is some consensus on at least the most important issues, the scientific contribution to policy can be extremely useful, even if some disagreements on specific issues remain. The IPCC is a good example of broad scientific consensus leading to major policy change and the global scale. In our particular case, the WWF Eco-regions, there might be disagreements and the scheme is certainly not perfect. However, as the scheme is broadly accepted, and has been internalised by WWF, it is good enough for the organisation to make strategic plans on the allocation of resources for conservation on the ground.

AA: Existing prioritisation schemes such biodiversity hotspots, Global 200, or Endemic and Important Bird Areas necessarily suffer from data inadequacies, and also reflect the interests and values of the NGOs that generated them. Is there a need for objective reviews of the merits of these schemes, and alternative scenarios? Or do you think these schemes are so institutionalised that
reviews would confuse decision makers, compromise public and financial support for conservation and therefore ultimately be counter-productive?

NB: It is certainly the job of academic biogeographers to challenge those schemes and come up with something better. These schemes do reflect to some extent the values of those NGOs that generated them. WWF focuses on priorities based on ecological representation and broader landscape conservation, BirdLife International focuses on birds, Conservation International on threatened species, etc. Thus, at the moment it is right to say that all these organisations have their own philosophies reflected within the conservation schemes they developed. They have also spent so much time and effort on developing their schemes that it is difficult for them to leave them aside. In addition these prioritisation schemes become a part of NGO branding and fundraising strategies. However, it would still be useful if all conservation organisations could bring together their schemes and develop a joint set of priority areas, and if academic biogeographers were able to engage in this discussion to ensure scientific rigour.

AA: Do you think there is some confusion about the goals of the conservation priority schemes? For conservation organisations, these schemes are part of their institutional branding, fund raising strategies and strategic planning, and not an attempt to devise a totally scientifically robust globally valid set of conservation priority areas valid for all taxonomic groups. Biogeographers on the other hand criticise the schemes on these grounds. I expect that there is some confusion. Organisations develop their own set of priorities, which are based on their conservation goals and becomes a part of their institutional branding. In fact, the schemes may determine to a large degree what the organisation is about. BirdLife International, for example, invests considerable resources on collecting data on Important Bird Areas, and on conserving these sites in the field.

AA: In your view, do existing conservation priorities such biodiversity hotspots, Global 200, or Endemic and Important and Endemic Bird Areas concord with the state-of-the-art biogeographical research? Where would you place each of them on a continuum from “minimally scientifically robust” (1) to “extremely scientifically robust” (10)?

I would put all these schemes on the same level. They are equally good and valid in their own ways. They are also not perfect and have not been developed to be fully scientifically robust. Nevertheless, they are useful frameworks for setting out conservation plans for institutions using the best available data. In terms of a fully scientific approach, the conservation biogeographical schemes are not fully hierarchical, and do not provide statistics on their confidence limits or degree of ‘difference’ between the various zones. They primarily exist at the same level of importance above a minimum threshold that has been predefined using expert opinions. As an example, WWFs Ecoregions could be developed in statistical way, using the available global species distribution data. This is an area where the biogeography community could provide a valuable contribution and might work together with conservation scientists.

AA: Do you think that idealistic prioritisation schemes have much relevance on the ground (other than attracting funding)? I.e. is it useful to have these benchmarks although they are (1) necessarily based on incomplete data and (2) generally do not take into account political or socioeconomic constraints?

NB: Yes, I think they are useful. They are for example institutionally helpful in that they help an organisation to define where it wants to work. BirdLife International works with its partners to identify and protect Important and Endemic Bird Areas, and within the WWF network all the national WWF organisations undertake much of their conservation work on the ground within Global200 areas. This is really helpful in setting the regions for action. The prioritisation schemes also help to bring countries together. If an Ecoregion covers three countries there is need for transnational collaboration, thus, these schemes partly also get people to think across the border. In the actual implementation of projects a whole new process starts where political and socioeconomic issues are often also addressed.

Communication between biogeographers and conservation practitioners

AA: Do you think that biogeographers communicate the applicability of their research findings to conservationists adequately? And vice versa, do
conservationists adequately communicate their information needs to biogeographers?

**NB:** I think that there is a general lack collaboration, understanding and acceptance. This might be because the agendas are different: the academic agenda is to try and publish papers in the best scientific journals whereas the NGO agenda is to identify areas where they can work on practical conservation on the ground. Often their approaches are simple and quite rapidly undertaken, so that they are easy to explain, can become part of the agencies ‘brand’, and help direct the work of the NGO. Once the work is finished, the NGO is then likely to stick to what they developed as it becomes a part of the institutional structure and public face of that organisation.

**AA:** Is an intensified exchange between conservationists and biogeographers necessary, and if so, where do you see potential platforms for this?

**NB:** One of the problems is that most conservation organisations have already defined their conservation biogeographical frameworks of the world. In order to develop a meaningful interaction between academic and conservation biogeographers, one or more of the NGOs would need to decide they wanted to look again at the conservation prioritisations that had developed. At this point there could be extensive opportunities for collaborations and to use the latest scientific findings and techniques for the development of such schemes. Another option for extensive collaboration between biogeographers and conservationists would arise if the conservation organisations all decided to sit together and to develop a joint set of conservation priorities.

**AA:** Thanks very much for this interesting interview! Are there any further thoughts you would like to share?

**NB:** I think that an extremely valuable contribution academic biogeographers could make would be to develop a statistically defined hierarchical model of conservation prioritisation areas that would include aspects relevant to conservation, such as endemic species, species richness, threatened species and important ecological processes.

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**obituary**

**Professor Chris Humphries (1947—2009)**

Botanist and biogeographer, Natural History Museum, London

Chris Humphries, a major player in the cladistic revolution in systematic biology, a revolution that changed the way biologists established evolutionary relationships among plants and animals and interpreted their geographical distribution, died Friday 31st July, 2009.

Chris was trained as a botanist specialising in Asteraceae, a group of daisies, but would eventually publish on a wide range of scientific issues. Aside from botanical taxonomy, Chris published on general issues in systematic biology, botanical art and its relation to 19th century scientific exploration, and conservation biology. He was a talented lecturer, held in high esteem by his many students. His infectious enthusiasm and considered knowledge meant he was sought out by many, none would he refuse to talk to, from undergraduate student to minister of state.

Chris spent his entire career as a research scientist in the Botany Department of the Natural History Museum, London, starting in 1972 as Assistant Curator of the European Herbarium, becoming its Head Curator in 1979 and, after some departmental restructuring, Division Head of Flowering Plants Research in 1997 until his retirement in 2007. During that period Chris had three sabbaticals, the first as a Research Fellow at the University of Melbourne, Australia (1979—1980), the second as a Senior Research Fellow at Melbourne (1986), and third as a Fellow of the Wissenschaftskolleg zu Berlin (Institute for Advanced Study, Berlin) (1994).

Chris’s gained his PhD from Reading University in 1974 working on the endemic genus *Argyranthemum* from Macaronesia. This study was Chris’s entry into systematics and biogeography, a
study that coincided with the beginnings of the cladistic revolution. Alongside Scandinavian colleagues, Kåre Bremer and Hans-Erik Wanntorp, also studying Asteraceae, the 1970s and 1980s was significant for developing, exploring and promoting cladistic systematics and cladistic biogeography in botany, ideas which have their origin with the German entomologist Willi Hennig and the interpretation of his core ideas by the Swedish entomologist Lars Brundin. Brundin’s work was embraced and developed by the palaeoichthyological community who went to study at Stockholm University with Erik Helge Osvald Stensiö (1891—1984). These scientists included Gareth Nelson and Colin Patterson, the latter of the Palaeontology Department of the Natural History Museum, although Chris did not meet Colin until 1975, after he (Colin) had lectured to the staff of the Museum in London on cladistics. Of Brundin, Patterson later wrote: “After ten years work in that field, I read Brundin and still recall the excitement with which I realized that there is a logical basis to evolutionary relationships which I had never seen discussed”. Brundin was first a biology teacher; one of his pupils was Hans-Erik Wanntorp; Bremer and Wanntorp were both at Stockholm University.

If Hennig’s work could be summed up succinctly one can do no better that note the unpublished words of Colin Patterson (1933—1998), spoken at his Systematics Association annual general meeting lecture in 1995: “What we all learned from Hennig back in those early days boiled down to just one thing, what relationship means. No one had put it plainly before. Once you agreed what relationship meant, how to recognise it became obvious – synapomorphy, and then it was also obvious what was wrong with systematics as we’d been practising it in the 50’s and early 60’s, when everyone was preoccupied with polyphyly. Our mistake was thinking in terms of origins rather than relationships – Darwin may well be to blame for that preoccupation. Anyway, origins has been a dirty word to me ever since, a symptom either of ignorance or of creationism”.

The revolution in historical biogeography also had its beginnings with Hennig and, again and more significantly, with Brundin’s vicariance interpretation of the southern hemisphere patterns of distribution in chironomid midges. Bremer and Wanntorp were the first to note vicariance biogeography in the context of botanical phylogenetic systematics, but it was not until Chris’s vicariance interpretation of the southern beeches (Nothofagus) that any serious work on cladistic biogeography was undertaken by a botanist.

Chris’s interest in biogeography developed during these next years, significantly enhanced by his association and collaboration with Lynne Parenti (of the Smithsonian Institute, Washington, USA) and Pauline Ladiges (of the University of Melbourne, Australia), producing two editions of the classic textbook *Cladistic biogeography* with Parenti and a series of papers applying rigorous cladistic biogeographic analyses to several groups of Australian eucalypts with Ladiges.

All revolutions lead to conflict with the prevailing orthodoxy, and the battles between the old and the new slipped out of the gentile academic circles of the Natural History Museum and into public view. Eventually, cladistic systematics and biogeography became accepted helped along by the publication of *Cladistics: A practical course in systematics* (1992), which Chris co-authored, and *Cladistic Biogeography*, both becoming standard texts.

At the same time, Chris’s interest in art and Australia made him perfect for organising and annotating the first complete full-colour edition of

Chris Humphries in June 2006. Picture courtesy of Dick Vane-Wright
The four invited-speakers symposia that will be held in the Crete meeting have now been decided upon. The list includes the following:

1. **Analytical advancements in macroecology and biogeography** (organizers: Alexandre Diniz-Filho & Carsten Rahbek)

2. **New Perspectives on Comparative Phylogeography – novel integrative approaches and challenges** (organizers: Ana Carnaval & Mike Hickerson)

3. **Biogeography and Ecology: Two Lenses in One Telescope** (organizers: Dave Jenkins & Bob Ricklefs)

4. **Mediterranean biogeography: where history meets ecology across scales** (organizers: Spyros Sfenthourakis & Rémy Petit)

Besides these symposia, additional thematic sessions will host contributed presentations, following the model started in the Mérida meeting. The nature and topics covered by each session will be decided in the near future.

**Jens-Christian Svenning**
V. P. for Conferences
Spyros Sfenthourakis
Organizing board of the 2011 IBS meeting
Job announcements

2-year postdoc project
Ecoinformatics & Biodiversity Group, Department of Biological Sciences, Aarhus University, Denmark
Supervisor: Professor Jens-Christian Svenning
Topic: What determines the global patterns of palm species diversity?

The postdoc candidate is expected to provide cutting-edge expertise in macroecological analyses and to have strong collaborative skills. Applicants should preferably have a PhD degree from a university outside Denmark.

Salary depends on seniority as agreed between the Danish Ministry of Finance and the Confederation of Professional Union, but is expected to be in the vicinity of 520.000 DKK ~ 69.000 Euros per year (before tax).

The position is officially announced here: http://science.au.dk/en/positions-and-fellowships/academic-positions/, where you will also find a link to the online application facility. The application deadline is October 19, 2009. If you apply, please also send an email to Professor Jens-Christian Svenning: svenning@biology.au.dk.

Postdoctoral positions and PhD studentships
Center of Macroecology, Evolution and Climate — Danish National Research Foundation — University of Copenhagen and Technical University of Denmark

Postdoctoral positions and PhD studentships in Macroecology, Biogeography, Evolution, Population Biology, Oceanographic Processes, Climate, Conservation Biology, and Environmental Economics

A number of positions are available to work within an integrated terrestrial and marine research program addressing fundamental questions on the origin, maintenance, conservation and future of life and biological diversity on Earth.

Candidates should have a strong publication record, relevant analytical and data handling skills, and an ability to communicate within a research team. Competitive salaries are offered.

Fuller descriptions of individual positions within 16 themes are at http://www.bio.ku.dk/om/jobs. Application must be based on the full description of the positions, and submitted before 31 of October. For enquiries about the program, contact Professor Carsten Rahbek, crahbek@bio.ku.dk.

Upcoming events

11th International Congress on the Zoogeography and Ecology of Greece and Adjacent Regions
21-25 September 2009 – Irakleion, Crete, Greece
http://www.nhmc.uoc.gr/iczegar11/

XIII World Forestry Congress
Forests in development. A vital balance
18-23 October 2009 – Buenos Aires, Argentina

ASEAN Conference on Biodiversity 2009
21-23 October 2009 – Singapore
http://www.aseanbiodiversity.org/

2nd DIVERSITAS Open Science Conference
Biodiversity and society: Understanding connections, adapting to change
13-16 October 2009 – Cape Town, South Africa
http://www.diversitas-osc.org/

BIOLIEF 2009
World Conference on Biological Invasions and Ecosystem Functioning
27-30 October 2009 – Porto, Portugal
http://www.ciimar.up.pt/biolief/

3rd International Barcode of Life Conference
9-13 November 2009 – Mexico City, Mexico
http://dnabarcodes2009.org/

If you want to announce a meeting, event or job offer that could be of interest for (some) biogeographers, or you want to make a call for manuscripts or talks, please contact us at ibs@mncn.csic.es and frontiersofbiogeography@gmail.com.
TDWG 2009
Biodiversity Information Standards. e-Knowledge about biodiversity and agriculture
9-13 November 2009 – Montpellier, France
http://www.tdwg.org/

SAFARI Symposium
Remote Sensing and Fisheries
15-17 February 2010 – Kochi, India
http://www.geosafari.org/kochi

VI Southern Connection Congress
Gondwana reunited: a southern perspective for a changing world
15-19 February 2010 – Bariloche, Argentina

9th Meeting on Vegetation Databases
Vegetation databases and climate change
24-26 February 2010 – Hamburg, Germany
http://netphyd.floraweb.de/?q=node/42

2010 AAG Annual Meeting
Association of American Geographers
14-18 April 2010 – Washington DC, USA
http://www.aag.org/annualmeetings/

The Evolution of Pacific Biota
20-22 May 2010 – Honolulu, Hawaii, USA
http://www.pacificscience.org/meetings.html

7th European Dry Grassland Meeting
Succession, restoration and management of dry grasslands
28-31 May 2010 – Smolenice, Slovak Republic
http://www.edgg.org

95th ESA Annual Meeting
Ecological Society of America
1-6 August 2010 – Pittsburgh, USA
http://www.esa.org/pittsburgh/

25th International Ornithological Congress
22-28 August 2010 – Campos do Jordão, Brasil
http://www.ib.usp.br/25ioc/

BES Annual Meeting 2010
British Ecological Society
7-9 September 2010 – Leeds, UK
http://www.britishecologicalsociety.org/

VI Spanish congress of biogeography
7-11 September 2010 – Alicante, Spain
http://web.ua.es/es/vi-congreso-biogeografia/

5th International Conference of the International Biogeography Society
January 2011 – Crete, Greece
http://www.biogeography.org/
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The scientific magazine of the International Biogeography Society

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