PART 1

ROOTS, RELEVANCE, AIMS AND VALUES
CHAPTER 1

THE ROOTS OF CONSERVATION BIOGEOGRAPHY

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1.1 WHAT IS CONSERVATION BIOGEOGRAPHY?

For those poor souls trapped in narrow scientific disciplines there may be an excuse for introspection, but that is not the nature of biogeography. Biogeographers surely have a special responsibility to broaden the perceptions and awareness of policymakers and those coming new to the profession. (Koy Thomson, 1991, p. 477)

As many others have argued before us, we live in an era, sometimes dubbed the Anthropocene, in which our species has increasingly shaped the world around us, influencing the physical and biological components of ecosystems at every scale from that of our own immediate surroundings up to the whole Earth system. We have developed, sometimes purposefully, but often haphazardly and accidentally, the habit of extinguishing species of plants and animals, domesticating them, assisting their spread to new territories, messing around to varying ends with their genetics and biology, and resorting them into novel communities embedded in so-called ‘cultural’ landscapes. In short, we have become the dominant force in altering the distribution, composition and diversity of life on Earth, with outcomes that are sometimes beneficial to the human condition and sometimes not, depending on which changes we are considering and the perspective of the observer.

Biologists have documented and modelled these changes in ecology and biogeography while articulating ever-increasing concern over the many perceived threats to biodiversity. The modern conservation movement has grown and evolved in response to these threats, with the most prominent national and international conservation organizations setting their sights on using the best possible scientific guidance to target resources on conserving whatever aspect(s) of biodiversity they value most highly. This book is written with the aim of providing a resource for those wanting to contribute to this endeavour.

There are many books on conservation biology, so it is valid to ask why we need one on conservation biogeography and what is the operational remit of the field? We have previously defined ‘conservation biogeography’ in the following terms: ‘the application of biogeographical principles, theories, and analyses, being those concerned with the distributional dynamics of taxa individually and collectively, to problems concerning the conservation of biodiversity’ (Whittaker et al., 2005, p. 3).

As shown schematically in Figure 1.1, this identifies conservation biogeography as a sub-set or sub-field of conservation biology. If it is a sub-field, then it is one with deep roots in the natural sciences. In broad terms, conservation biogeography is concerned with pattern and process over large extents of space (and time), so we have therefore mostly excluded from this book
4 The roots of conservation biogeography

1.2 THE EMERGENCE OF CONSERVATION BIOLOGY AND CONSERVATION BIOGEOGRAPHY

Real-world biogeographers must balance their roles as citizens wanting to make the world a better place against their roles as scientists who are honest and skilful about their scientific limitations. Getting the science right is undoubtedly important for making policy decisions, but a wise approach to uncertainty is all the more so.

(Thomson, 1991, p. 475)

As an applied and interdisciplinary science concerned with the conservation of nature, conservation biogeography can be seen as a product both of biogeography and of conservation biology. We briefly consider the origins of these related endeavours by the order of their emergence (Figure 1.1).

Biogeography is the study at all scales of analysis of the distribution of life across space and how it has changed through time. In the broadest sense, biogeography could even be thought of as the 'first science', because the ability to understand and track the distribution of food and predators through time and space was arguably of even greater interest to our hunter-gatherer ancestors.

Although the term biogeography appears to have been a 20th century innovation, the discipline has deep scientific roots. Many of the core principles and broadly known patterns of biogeography were established and debated before the end of the 19th century under the twin headings of zoogeography and phytogeography, by such towering figures as Alfred Russel Wallace (sometimes called the father of zoogeography), Charles Darwin, Philip Sclater, Georges-Louis Leclerc (Compte de Buffon), and Alexander von Humboldt (Lomolino et al., 2004, 2006). Indeed, some of the major themes were already established as areas of enquiry by the early 1800s: indicative of the foundational nature of the subject within the natural sciences (Lomolino et al., 2004, 2006). The study of biogeography thus developed in advance of the coalescence of theory and thinking that came to constitute the disciplines of ecology and evolution, with which the subject of biogeography is naturally intertwined.

Biogeography has many facets, traditions, and schools of thought. They encompass deep time (historical biogeography), the recent past (palaeoecology) and contemporary pattern and process (ecological
biogeography). At the core of the discipline is an interest in describing, explaining and predicting patterns of distribution and diversity, whether at higher taxa level, species level, or most recently also sub-species levels of analysis.

The modern conservation movement emerged in the late 19th century in response to fundamental changes in world views concerning the nature of the relationship between humans and the natural world, and it emanated largely from the elite society of the American East Coast and Western Europe (Jepson & Whittaker, 2002a). The movement was motivated both by a desire to preserve sites with special meaning for the intellectual and aesthetic contemplation of nature, and by acceptance that the human conquest of nature carries with it a moral responsibility to ensure the survival of threatened life forms. These early principles were later combined with a range of more utilitarian perspectives but, over the first half of the 20th century, the primary motivating forces were the conservation of wildlife, especially large game animals and birds, and the desire to preserve places of natural beauty and wonder (Figure 1.1, Box 1.1).

Over time, the conservation movement diversified with increasing recognition of other (often deeply rooted) motivating ideas alongside the immediate imperative of saving particular types of species from extinction. Thus, nature conservation can be thought of as a social movement working to develop or reassert certain values in society concerning the human/nature relationship (Jepson & Whittaker, 2002a). The movement gained new momentum in the second half of the 20th century, when science and environmentalism further expanded understandings of our relationship with nature (Frank et al., 1999; Adams 2004).

Motivated by, but distinct from, the nature conservation movement, ‘conservation biology’ is the name given to applied research designed to inform management decisions concerning the conservation of biodiversity. As such, its roots lie largely within the mid 20th century. Conservation biology gained huge momentum during the 1970s and early 1980s, when it was formally identified as a sub-discipline, with dedicated journals and textbooks (e.g. Soulé 1986; Primack, 2002) and learned societies such as the Society for Conservation Biology, founded in 1986 and presently with over 10,000 members.

Conservation biology can be defined narrowly as being concerned with the application of population biology, taxonomy and genetics to problems concerning the conservation of biodiversity. In a now classic paper, Graham Caughley (1994) pointed out that conservation biology research mainly operates within two overriding paradigms - studies that seek an understanding of the proximate causes of population decline (the declining population paradigm) and those that are concerned with the consequences of small population size (the small population paradigm).

More recently there has been an acknowledgement that a biological understanding of rarity and endangerment is necessary, but not sufficient for policy-making designed to prevent biodiversity loss, and that conservation biology needs to incorporate a far broader range of disciplines. Indeed, conservation biology textbooks typically include a wider array of basic scientific and other academic disciplines, including such fields as anthropology, biogeography, environmental economics, environmental ethics, sociology and environmental law (e.g. see Primack, 2002). The incorporation of the social sciences under the umbrella of conservation (i.e. biological) science represents a recognition of the need to apply multiple forms of scholarship to address complex real-world problems. It may also reflect a general desire to bestow scholarly discourse and guidance with the additional gravitas associated with a ‘proper science’ given the status of scientific guidance within late 20th century society and politics (see, e.g. Knight & Cowling, 2007).

Last to emerge within the framework shown in Figure 1.1 is conservation biogeography, a term that began to gain currency via a conference of the International Biogeography Society in Washington in January 2005 (Lomolino & Heaney, 2004), and that we ourselves promoted through a paper published the same month in the journal Diversity and Distributions, which simultaneously gained the sub-title ‘A Journal of Conservation Biogeography’. We subsequently realized that the term had been first coined at least twelve years earlier by John Grehan (1993) in the title of a paper in the first issue of the same journal (then called Biodiversity Letters), although he did not define in any precise way what he meant by the term.

Whereas the formal use of the term may be recent, the use of biogeography within conservation biology has been going on for as long as scientific guidance to conservation has been offered, and biogeography indeed formed a central part of early theory within conservation biology (see, e.g. Primack, 2002). Classic foundational works combining biogeographical analysis with conservation guidance include the early papers...
applying island theory to the problem of habitat fragmentation (e.g. Diamond, 1975a) and Dasmann’s (1972) biogeographical regionalization approach to designing networks of protected areas (see Chapters 8 and 5, respectively).

Although biogeographical science has played its part alongside other sub-fields of biology in the emergence of current scientific guidance for biodiversity conservation, in our view it has done so as something of a poor relation – a Cinderella within conservation biology. We argue that biogeography can now cast aside its metaphorical rags as it emerges as a subject area of central importance to conservation planning. In part, this repositioning of biogeography is the result

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**Box 1.1 General characteristics of three broad themes and phases of the conservation movement**

The modern conservation movement can trace its roots back to various societies, clubs and social movements that formed in the late 19th century in response to a variety of changes in society and the natural world (reviewed in Chapter 2; and in Jepson & Ladle, 2010). Two themes were particularly prominent:

1. **Wildlife conservation**, in the sense of ‘[t]he controlled use and systematic protection of indigenous fauna’. (Matthews et al., 2001) This part of the early conservation movement was rooted in the natural history and hunting pastimes of elite society of the 19th century and is exemplified by the creation of the Boone and Crockett club (B&CC) in 1887 by future US President Theodore (Teddy) Roosevelt. The B&CC had two main goals: first, to create sanctuaries and refuges where wildlife could survive the onslaught of human expansion into frontier lands; and second, to change the culture of hunting to exalt the noble qualities of the chase above the number of animals killed (Jepson & Ladle, 2010).

2. **Nature conservation**, which stemmed from ideas of nature as being delicate and intricate system(s) sensitive to human interference. This idea manifested itself in the preservation of the status quo and of nature monuments – places for the contemplation of nature, antidotes to urban life. The concept of nature monuments was promoted particularly by the German forester Hugo Conwentz (discussed further in Chapter 2).

Both nature conservation and wildlife conservation sometimes resulted in a ‘fortress conservation’ approach, where areas were fenced off from the local communities in order to save them – or at least save them for exclusive exploitation by Western interests.

3. **Biodiversity conservation**. The contemporary approach to conservation embraces both of the above sets of values and more besides, but can be crudely characterized as distinct from the above by its emphasis on attempts to conserve biodiversity. The term ‘biodiversity’ is simply a contraction of ‘biological diversity’ and may have first been used in a scientific study by Elliot Norse in a US government report in 1980. However, it is more commonly attributed to Walter Rosen around 1985 while planning a symposium; it was used in the title of the resulting 1988 symposium volume (Wilson, 1988a) and subsequently gained rapid uptake.

Biodiversity has many definitions, one prominent one being ‘[t]he variability of life from all sources, including within species, between species, and of ecosystems’ (Matthews et al., 2001). It is, in its character, a scientific/technical term, although it is important to bear in mind that the study of biodiversity is not solely a branch of biology as it has an ethical/social dimension (Jeffries, 1997). Moreover, some commentators have noted that biodiversity definitions are often closer to subjective ‘value judgement’ concepts such as quality of life than an objective measure of an environmental property (Lambshead & Boucher, 2003). Although most definitions of biodiversity stress the complexity of life at multiple levels (e.g. genes, species, ecosystems), ‘biodiversity conservation activities are typically directed toward species’ (Matthews et al., 2001, p. 50).
of the recent and huge technological advances in biogeographical data collection, storage and analysis, which have enabled rapid progress in many areas of the field, both pure and applied; and, in part, it reflects theoretical and conceptual advances (e.g. Williams et al., 2000; Lomolino & Heaney, 2004).

Yet we must also recognize that the underlying species distributional and other data often remain highly problematic, protocols for analysis are still in the early stages of development, and we have only recently begun the task of systematically analysing the sensitivity of our analyses to the starting assumptions and scale effects. There is an enormous degree of uncertainty in our science when it comes to predicting future distributions of taxa, diversity and biogeography (see Chapter 7). Accordingly, we argue that there is a need for more biogeographers to engage with the problems of conservation science, and for the injection of more biogeography into training for conservation scientists and practitioners.

### 1.3 THE SCOPE OF CONSERVATION BIOGEOGRAPHY

As we have indicated above, conservation biology is a large and all-embracing field. However, if it is subdivided by scale of application, we might recognize the following subdivisions of relevant theory (Figure 1.1):

1. **Population scale**: the development and evaluation of biological theory spanning population biological and genetic process. This is concerned with deterministic processes of population decline, population viability, genetic erosion from small populations, competitive influence of invasive species, behavioural ecology and so forth, i.e. concerns with processes in which biogeography is generally not prominent (e.g. see Caughley, 1994; Primack, 2002).

2. **Landscape scale**: theory concerning processes at the local–landscape scale, including the foundational influence of R.H. MacArthur and E.O. Wilson’s equilibrium theory of island biogeography, the derivative Single Large or Several Small reserves (SLOSS) debate, habitat corridors and matrix effects, metapopulation theory and nestedness (reviewed by Whittaker and Fernández-Palacios, 2007), i.e. issues clearly bridging ecology and biogeography.

3. **Geographical scale**: applications on a yet coarser scale in part are concerned with mapping and modelling biogeographical patterns, and they in part invoke historical–biogeographical theory concerned with the distribution and explanation of geographical patterns in diversity. We see such coarser scale work on the geography of nature as being unambiguously within the heartland of biogeography (cf. Lomolino et al., 2004). Despite its undoubted importance within conservation science, we argue that it is here, in particular, that something of a ‘Cinderella’ tag applies to conservation biogeography; likewise, it is here where there is greatest need for critical attention to our science and for greater interaction between those involved in theory and application (see e.g. Lourie & Vincent, 2004).

Conservation biogeography, the application of biogeography in conservation, is thus separable from the application of other areas of biology (i.e. community, population and behavioural ecology, macroecology, and genetics), most clearly at coarser scales of analysis. While the use of zoogeographic regions, areas of endemism, geographic patterns in species richness, or phylogeographic structure for conservation prioritization purposes are readily identifiable as conservation biogeography, applications at increasingly fine spatial scales, for example focused on habitat corridors or metapopulation dynamics, can be seen as simultaneously drawing from traditions in both ecology and biogeography.

Similarly, macroecological analyses (referring to the analysis of the emergent statistical properties of ecological data sets (Brown, 1995)) may also be based on both ‘ecological’ traits (e.g. growth rates, propagule size, breeding system, body size) and ‘biogeographical’ traits (e.g. range size, region of origin). In illustration, efforts to develop explanatory and predictive models of invasiveness of non-native species have been made that use both sets of traits, frequently finding a biogeographical signal in the resulting models (Dehnen-Schmutz, 2004; Pyšek et al., 2004), which indicates that such analyses draw from both ecological and biogeographical traditions within conservation science to varying degrees. For further exploration of key scale and diversity concepts relevant to conservation biogeography, see Box 1.2.

#### 1.3.1 To what ends?

While our goal in this book is to provide students with a guide to the scientific underpinnings of conservation decision-making, it is important to recognize that such
Box 1.2 Key diversity and scale concepts

The first of the tables below is adapted from Whittaker et al. (2001) and highlights the varied meanings of the term species diversity, which itself is just one meaning of the term ‘biodiversity’ (see Box 1.1). Although the table refers to species as the unit of analysis, the terms can of course be applied at other taxonomic levels. The terms given here have been used in varied and inconsistent ways in the literature, leading to much confusion within diversity theory.

Within species diversity terminology, perhaps the key distinction is between metrics and concepts recognizing differences in the number of species (which are forms of inventory diversity) and those that highlight the degree to which species are shared between or unique to (endemic to) the areas being compared (which are forms of differentiation diversity). This distinction is set out in Table B1.2b, which provides the foundational framework for the scale of application, designated by letters of the Greek alphabet, developed by the American ecologist Robert Harding Whittaker (e.g. 1960, 1977).

R.H. Whittaker’s framework provided a nested sequence from inventory to differentiation forms reiteratively (Figure B1.2a). As his first inventory tier was termed alpha diversity and his first differentiation tier was termed beta diversity, he sometimes used the two terms interchangeably, a habit followed by many other authors, sometimes with confusing outcomes. In practice, diversity and other biogeographical patterns described at different focal scales of analysis may well be the outcome of different dominant processes, so it is of critical importance that the scale parameters of a study are explicitly taken into account when synthesizing information within biogeography, not least within conservation biogeography (see discussion in Whittaker et al., 2001, 2005).

<table>
<thead>
<tr>
<th>Diversity concepts</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>species diversity</td>
<td>varied meaning: e.g. number of species, or indices weighted by abundance distributions of species (equitability); implying of itself no standardization of sampling</td>
</tr>
<tr>
<td>species richness</td>
<td>number of species, implying of itself no standardization of sampling</td>
</tr>
<tr>
<td>species density</td>
<td>number of species in a standardized sample, e.g. per unit area; more precise than the above but less widely adopted</td>
</tr>
<tr>
<td>species turnover, i.e. differentiation diversity</td>
<td>in the present context meaning compositional turnover in space between two inventory (typically alpha-scale) samples, expressed by a variety of indices or multivariate analyses, and thus qualitatively different from species richness or density</td>
</tr>
<tr>
<td>endemism</td>
<td>an endemic is simply a species (or other taxonomic entity) confined to a particular geographical area; a focus on areas of high numbers of endemics implies an interest in biogeographical distinctiveness (whether at species or other taxonomic level)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scale concepts</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>spatial scale</td>
<td>should refer to the size of the base unit used in sampling and analysis, but in practice usage of this term varies such that it may mean either or both of ‘extent’ and ‘focus’; moreover, size of sample unit is very often not held a constant (as it should be) but is allowed to vary within a study</td>
</tr>
<tr>
<td>(geographical) extent</td>
<td>the geographical space (distance) over which comparisons are made, whether they be using e.g. 1 m$^2$ or 10,000 km$^2$ sample units; i.e. of itself implying nothing about spatial scale in the strict sense</td>
</tr>
<tr>
<td>focal scale</td>
<td>the spatial scale at which data are analysed, being either the size of the sampling unit (also called the ‘grain’) or the unit to which these data are aggregated for analysis (e.g. local or field scale to regional scale); this concept, unlike ‘extent’, can be synonymous with spatial scale</td>
</tr>
</tbody>
</table>

Table B1.2a Key diversity and scale concepts. Modified from Whittaker et al. (2001, Table 1).
Table B1.2b Terminology used in describing diversity patterns at different scales of analysis. This table has been compiled and modified from various sources, notably R.H. Whittaker (1975, 1977); Stoms & Estes (1993); R.J. Whittaker et al. (2001).

<table>
<thead>
<tr>
<th>R.H.W. tiers</th>
<th>Spatial scale</th>
<th>Description</th>
<th>Nature of diversity metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>point</td>
<td>species found at a precise point within a local community, e.g. contact of grassland plant species with a pin</td>
<td>inventory</td>
<td></td>
</tr>
<tr>
<td>Alpha</td>
<td>local</td>
<td>species richness within local communities/patches</td>
<td>inventory</td>
</tr>
<tr>
<td>Beta</td>
<td>landscape</td>
<td>turnover of species between local communities within a landscape</td>
<td>differentiation</td>
</tr>
<tr>
<td>Gamma</td>
<td>landscape</td>
<td>species richness of whole landscape</td>
<td>inventory</td>
</tr>
<tr>
<td>Delta</td>
<td>regional</td>
<td>turnover of species between landscapes along major gradients of climate and/or physiography</td>
<td>differentiation</td>
</tr>
<tr>
<td>Epsilon</td>
<td>regional</td>
<td>the species diversity of a broad region of differing landscapes</td>
<td>inventory</td>
</tr>
<tr>
<td>inter-regional/inter-provincial</td>
<td>replacement of higher taxa, e.g. placental mammals by marsupials</td>
<td>differentiation</td>
<td></td>
</tr>
</tbody>
</table>

Figure B1.2a An illustration of Robert Harding Whittaker’s diversity scale framework, showing how each scale of analysis nests within the next and highlighting the distinction between inventory diversity and differentiation diversity concepts. Re-drawn from Stoms and Estes (1993).
scientific guidance, and the language in which it is couched, is value-laden (see, for example, the passionate polemic by Stott, 1998) and that there is still a debate to be had concerning which properties of nature we wish as a society to foster (Trudgill, 2001).

Much of the scientific guidance and of current conservation practice assumes that this debate will have a particular and almost predetermined outcome, without paying much attention to the possible validity of alternative value systems (but see: Redford et al., 2003). For instance, we might wish to emphasize saving species from extinction as the prime goal, without paying great attention to the assemblages and landscapes they occur in. Or, we may wish to emphasize the importance of intact megafaunal assemblages, aesthetic and cultural significance of landscapes, ecosystem health, or biotic integrity (cf. Callicott et al., 1999; Redford et al., 2003; Adams, 2004). These ideas are linked to a similar diversity of social values motivating conservation action in many nations, especially at local scales, but also globally (Chapter 2; Jepson & Canney, 2001, 2003; Trudgill, 2001).

The decision to adopt a particular set of values is not within the bounds of science and, although conservation scientists are well placed to contribute to this debate, there is an important distinction between the processes leading to the adoption of a set of values and the process of deriving the scientific guidelines to implement these values. In our view, conservation biogeographers should be in the business of providing alternative scenarios that address differing end goals (cf. Williams et al., 2000; Dimitrakopoulos et al., 2004) if they are to place their science at the service of society so as to best inform decision-making processes.

To expand on this a little, any system of conservation prioritization, even if based on the application of numerical algorithms to comprehensive data sets, ultimately reflects value judgements about which features are important and how to weigh them up (Knight & Cowling, 2007). Applying funding or protection to areas ranked highly by the chosen protocols may, in the end, diminish the opportunity for conservation elsewhere, perhaps including other areas of pressing conservation concern. On the scale of landscapes, regions and states, biogeography is well placed to inform such choices.

Some, reading this introduction, may wish to contest the notion that values are separable from science at all, a view with which we have some sympathy. Indeed, as pointed out by Trudgill (2001), many of the terms in use in biogeography and conservation biology (e.g. ‘equilibrium’, ‘alien species’, ‘native species’, ‘climax community’ and ‘natural’) are deeply value-laden and defy easy objective definition.

Although not included in the chronology of ideas in Figure 1.1, crucial to the recent progression of the conservation movement has been the emergence during the late 1980s of the concept of ‘biodiversity’, a term of technical and scientific resonance but one that defies precise scientific definition (Takacs, 1996). Indeed, as noted in Box 1.1, it has been argued that biodiversity definitions are closer to being subjective ‘value judgement’ concepts (such as quality of life) than they are to being an objective measure of an environmental property. Most commonly used definitions imply in some way that biodiversity is a ‘good’ thing per se and that, conversely, biodiversity loss through human action is ‘bad’ and should be prevented or minimized.

Another difficulty implicit in many of the definitions of biodiversity, including that adopted by the 1992 Convention on Biological Diversity (CBD), is that biodiversity can, and should, be both conserved and used. The extent to which we regard these goals of conservation and development as compatible or in conflict describes, to a large degree, where we position ourselves as members of our society. How might this influence our work as scientists?

Similarly, others have observed that natural scientists working on conservation science problems have traditionally worked within rather static equilbrial frameworks that portray nature as unchanging in the face of abundant evidence of inherent variability and flux in many natural systems (Pickett et al., 1992; Wu & Loucks, 1995). The language used in the ecological and conservation literature, according to Stott (1998), frequently reveals a desire for ‘stability’ and ‘safety’ (the so-called ‘precautionary principle’), whereas in reality we live in a world in which change takes place all the time, in all sorts of directions and at all sorts of scales; everything is in flux (summarized from Stott, 1998, p. 1).

Stott calls for biogeographers and ecologists to wake up to the non-equilibrium nature of the world around us and to re-examine the assumptions and the language we use in discussing environmental problems/opportunities and conservation. Although the so-called ‘balance of nature’ paradigm is rapidly being superseded in scientific circles by more dynamic conceptions of nature, as a handy metaphor it still has
considerable traction in society and is commonly used in popular discourse on conservation issues (Ladle & Gillson, 2009).

How much do such frames of reference continue to influence the science we conduct and how we interpret our data? While our focus in this book is very much on the way that biogeographical science can contribute to conservation, we recognize that these and other critiques of the objectivity of our science require that we pause to consider the interaction between social values, the conservation movement and biogeographical science. Hence we devote chapters in this opening part of the book both to a consideration of values motivating conservation action (Chapter 2), and a consideration of the concept of alternative ecological (scientific) baselines and how they may inform conservation (Chapter 3).

From this brief outline we wish to highlight three points. First, the conceptual origins of biogeography as an academic discipline substantially predate the emergence of conservation biology. Second, conservation biogeography forms an important and distinctive (but not entirely distinct) subset of conservation biology. Third, the motivating force for these scientific endeavours is a diverse and dynamic social movement, representing varied values and world views.

1.4 OUTLINE OF THE FOLLOWING CHAPTERS

Edited books can sometimes be a bit fragmented. In Conservation Biogeography we have tried to avoid this by imposing a strong structure, prescriptive content and strong editorial guidelines throughout the process of developing the text. It is our hope, therefore, that the book can be read either as a single cohesive narrative or as ‘stand-alone’ chapters.

The book is divided into four major parts. The first part, Roots, relevance, aims, and values (Chapters 1–3) has the aim of providing the historical and philosophical context of conservation biogeography, as well as introducing key terminology and frames of reference. Chapter 2, Social Values and Conservation Biogeography, focuses on the frequently neglected subject of the values underlying decisions to prioritize or protect certain geographic areas for conservation, and how to manage those areas once they have been designated. The key point is that decisions about where, what and how to conserve may be based on hard data and scientific principles, but are ultimately a reflection of different values within society or the global conservation community.

Chapter 3, Baselines, patterns and process, examines the two main conceptual approaches underpinning modern conservation practice – compositionality and functionalism – and how they have profound influences on conservation objectives. It also introduces the concept of ecological baselines and how these have become important targets for conservation and restoration (although in fact there may be multiple alternative baselines, states or dynamic frames of reference for the same region or landscape).

The second part of the book, The distribution of diversity: challenges and applications (Chapters 4–7), provides an overview of the current state of global biogeographical knowledge and how this knowledge has been used to better focus conservation efforts. Chapter 4, Basic biogeography: estimating biodiversity and mapping nature, focuses on what we know and what we don’t know about the distribution of biodiversity and the varying phenomena we may want to map (e.g. biogeographical regions, biomes, ecoregions, areas of endemism, evolutionary significant units, etc.). It also covers the varying approaches to species mapping and how to deal with challenges such as scale issues, representations of species ranges, and bioclimate envelope modelling and mapping.

Chapter 5, The shaping of the global protected area estate, gives an overview of the history and development of protected area planning frameworks at global to regional geographical scales. The chapter splits these frameworks into two main approaches: zonal, involving the mapping of attributes of nature into a suite of broadly climatically or historically determined non-overlapping areas (e.g. ecoregions); and azonal, involving the application of biogeographical principles to identify a particular set of disconnected places across the world (e.g. hotspots, important areas). Schemes based on these contrasting approaches have become key determinants of global funding and conservation action.

The final chapter of this part is Chapter 6, Systematic conservation planning: past, present and future. Here, the principles and applications of computer-based and data-intensive approaches to protected area network design are reviewed and discussed, covering important network design concepts such as complementarity, irreplaceability and redundancy and the development and application of reserve selection algorithms. The
chapter also contains extensive examples of how to conduct systematic conservation planning in marine and terrestrial ecosystems.

The third part of the book, Conservation planning in a changing world (Chapters 7–9), addresses some of the key challenges to undertaking effective conservation during a time of unprecedented ecological change. Chapter 7, Planning for persistence in a changing world, starts by comparing current ecological trends to past changes in the biota. It follows this by an extensive analysis of methods used to predict biodiversity change (e.g. species distribution models, range shift models). Using the insights from these studies, the chapter concludes with a discussion of the need for dynamic conservation planning approaches that are flexible and responsive to changing predictions about the potential fate of the natural environment.

One of the key biogeographical questions in conservation is how biodiversity will respond to the continuing and widespread loss and fragmentation of natural and semi-natural habitats. Chapter 8, Applied island biogeography, explores the implications of this insularization of formally contiguous ecosystems and reviews the pervasive influence of the equilibrium theory of island biogeography on the conceptual development and practice of conservation. The chapter covers important applied issues such as the use of the species-area relationship, efforts to model metapopulation dynamics, analyses of nestedness, edge effects and the efficacy of habitat corridors and the influence of varying types of matrix habitats on the abilities of threatened species to disperse between high quality habitat. It ends with a discussion of how conceptual advances can be converted into practical solutions and guidelines for conservation.

Part 3 concludes with Chapter 9, Biological invasions and the homogenization of faunas and floras, which tackles one of the greatest challenges in modern conservation: how to understand, control and manage introduced species. The chapter starts by reviewing the biogeography of invasion and the process by which regionally distinct, native communities are gradually replaced by locally expanding, cosmopolitan, non-native communities (homogenization). After brief review of patterns of homogenization by taxon, it addresses the human causes of this process and concludes with a discussion of what these novel assemblages might mean for the future of conservation.

The final part of the book, Future directions, contains a single chapter entitled Prospects and challenges, which discusses the future of conservation biogeography and focuses on the global challenge of filling the Wallacean and Linnean shortfalls, the rapid evolution of predictive models and the necessity to develop tools and applications that fulfill the needs of society to develop sustainably. The chapter casts an eye over new technological developments, such as the latest generation of biodiversity information systems that have the potential to radically alter the amount and quality of data available to biogeographers. The book concludes with some reflections on the role of conservation biogeographers in shaping the future of conservation and how to engage more fully with society and real-world conservation issues.

Each main chapter contains a selection of suggested key readings in addition to the extensive literature cited within the text. The purpose of these readings is to guide students to core texts, seminal papers or stimulating contributions that expand upon topics within the chapter. Each main chapter also concludes by raising a number of questions that could form the basis of a class discussion or may be used to test understanding of the material.

SUGGESTED READING


