Contents

Preface, x

1 Introduction to biogeography, 1
Order of chapters, 11
Further reading, 12
References, 13

2 A history of biogeography, 15
Lessons from the past, 15
Ecological versus historical biogeography, and plants versus animals, 18
Biogeography and Creation, 19
Distribution of life today, 21
Evolution—a flawed and dangerous idea!, 23
Enter Darwin, 24
World maps: the biogeographical regions of plants and animals, 25
Getting around the world, 28
The origins of modern historical biogeography, 31
The development of ecological biogeography, 36
Living together, 37
Marine biogeography, 39
Island biogeography, 41
Summary, 43
Further reading, 43
References, 43

3 Patterns of biodiversity, 45
How many species are there?, 46
Gradients of diversity, 52
Biodiversity hotspots, 60
Diversity in time, 62
Marine biodiversity, 68
Dynamic biodiversity, 68
Summary, 70
Further reading, 70
References, 70

4 Patterns of distribution, 73
Limits of distribution, 74
Overcoming the barriers, 75
A successful family: the daisies (Asteraceae), 77
Patterns of dragonflies, 80
Magnolias: evolutionary relicts, 83
Climatic relicts, 85
Endemic organisms, 89
Physical limitations, 90
Environmental gradients, 91
Interaction of factors, 96
Species interaction, 99
Invasion, 101
Reducing competition, 107
Migration, 110
Predators and prey, 112
Summary, 116
Further reading, 116
References, 116

5 Communities and ecosystems, 119
The community, 120
The ecosystem, 122
Ecosystems and biodiversity, 125
Biotic assemblages on a global scale, 128
Patterns of climate, 132
Modelling biomes and climate, 138
Biomes in a changing world, 140
Summary, 141
Further reading, 141
References, 142

6 The source of novelty, 143
Natural selection, 144
Darwin's explanation and Darwin's finches, 145
Controlling forces within the organism, 149
From populations to species, 150
Polyploids, 152
Barriers to interbreeding, 153
Competition for life, 155
The 'theory' of natural selection, 156
Controversies and evolutionary theory, 158
Evolution and the human race(s), 160
Summary, 162
Further reading, 162
References, 162

7 Life, death and evolution on islands, 165
Types of island, 166
Getting there: problems of access, 168

Dying there: problems of survival, 170
Integrating the data: the Theory of Island Biogeography, 172
Second thoughts about the Theory, 174
The Theory of Island Biogeography and the design of nature reserves, 176
Starting afresh: the story of Rakata, 179
The coastal environment, 180
Life inland, 181
Evolving there: opportunities for adaptive radiation, 186
The Hawaiian Islands, 190
Mechanisms of arrival, 192
Evolutionary radiations within the Hawaiian Islands, 193
Summary, 197
Further reading, 197
References, 197

8 Living in the past, 201
Plate tectonics, 202
Evidence for past geographies, 205
Early land life on the moving continents, 206
One world—for a while, 209
Rise of the flowering plants, 214
Late Cretaceous and Cenozoic changes in geography, ocean currents and climate, 216
Late Cretaceous and Cenozoic floral changes, 219
Summary, 222
Further reading, 222
References, 222

9 The geography of life today, 225
Mammals: the final patterns, 227
The distribution of flowering plants today, 233
Mammalian versus flowering plant geography: comparisons and contrasts, 235
The Old World tropics: Africa, India and South-East Asia, 237
Africa, 238
The Cape flora, 240
Madagascar, 241
India and South-East Asia, 242
Australia, 243
New Zealand, 245
The West Indies, 247
South America, 251
Late Cretaceous/Early Cenozoic, 251
Later in the Cenozoic, 251
Late Cenozoic/Pleistocene, 252
The Northern Hemisphere: Holarctic mammals and Boreal plants, 255
Summary, 258
Further reading, 258
References, 258

10 Ice and change, 261
Climatic wiggles, 262
Interglacials and interstadials, 264
Biological changes in the Pleistocene, 266
The last glacial, 268
Causes of glaciation, 274
The current interglacial: a false start, 279
Forests on the move, 282
The dry lands, 287
Changing sea levels, 288
Time of warmth, 290
Climatic cooling, 291
Recorded history, 293
Summary, 294
Further reading, 294
References, 295

11 Transforming the planet, 297
The emergence of humans, 297
Modern humans and the megafaunal extinctions, 303
Domestication and agriculture, 304
The biogeography of human parasitic diseases, 311
Environmental impact of early human cultures, 314
Summary, 315
Further reading, 316
References, 316

12 Drawing lines in the water, 319
Zones in the ocean and upon the sea floor, 323
Basic biogeography of the seas, 325
The open-sea realm, 326
Dynamics of the ocean basins, 326
Patterns of life in the ocean waters: biomes and provinces within the oceans, 329
Patterns of life on the ocean floor, 333
Biogeography of hydrothermal vent faunas, 336
The shallow-sea realm, 337
Faunal breaks within the shelf faunas, 339
Coastal faunas of islands, 341
Trans-oceanic links and barriers between shelf faunas, 341
Latitudinal patterns in the shelf faunas, 343
Coral reefs, 344
Summary, 350
Further reading, 350
References, 350

13 Interpreting the past: I. Molecular and isotopic biogeography, 353
The molecules of life, 354
DNA, RNA, enzymes and phylogeny, 356

The molecular clock, 358
Molecular evolution and bird biogeography, 359
Human biogeography and molecular methods, 362
Population crashes, bottlenecks and catastrophes, 363
Isotopes in biogeography, 365
Isotopes in biogeochemical cycles, 367
New horizons, 368
Summary, 369
Further reading, 369
References, 369

14 Interpreting the past: II. Principles and practice, 371
The great divide: dispersal versus vicariance, 371
Centres of dispersal and centres of origin, 374
Current methods of biogeographical analysis, 374
Phylogenetic biogeography, 376
Phylogeography, 377
Cladistic biogeography, 379
Generalized tracks, 380
Parsimony analysis of endemicity, 381
Endemicity and Pleistocene problems, 382
The 'New Zealand school' of panbiogeography, 385
Palaeogeography, 387
Summary, 388
Further reading, 388
References, 389

15 Foretelling the future, 391
The human population, 392
The changing climate, 395
Nitrogen and sulphur overload, 399
Other pollutants, 401
Biogeographical consequences of global change, 402
Population declines and extinctions, 406
Changing communities and biomes, 409
Where do we go from here?, 410
Summary, 413
Further reading, 413
References, 413

Index, 417

Colour plates between pp. 212 and 213