

CONTENTS

<i>Acknowledgements</i>	xxi
<i>Chronological table of reprinted articles and chapters</i>	xxv

General Introduction	1
-----------------------------	----------

VOLUME I HISTORY, BACKGROUND AND CONCEPTS

PART 1

What is biodiversity and how is it measured?	27
1 Conservation of biodiversity in a world of use	29
K. H. REDFORD AND B. D. RICHTER	
2 Indicators for monitoring biodiversity: a hierarchical approach	50
R. F. NOSS	
3 Measuring biodiversity value for conservation	68
C. J. HUMPHRIES, P. H. WILLIAMS AND R. I. VANE-WRIGHT	
4 Quantifying biodiversity: procedures and pitfalls in the measurement and comparison of species richness	89
N. J. GOTELLI AND R. K. COLWELL	
5 Global state of biodiversity and loss	115
R. DIRZO AND P. H. RAVEN	

PART 2

Origins of biodiversity	151
6 Modes of animal speciation	153
G. L. BUSH	
7 Adaptive radiation in a heterogeneous environment	183
P. B. RAINEY AND M. TRAVISANO	
8 Ecological causes of adaptive radiation	193
D. SCHLUTER	
9 Why are there so many insect species? Perspectives from fossils and phylogenies	222
P. J. MAYHEW	

PART 3

Geographic patterns of biodiversity	279
10 Global patterns in biodiversity	281
K. J. GASTON	
11 A comprehensive framework for global patterns in biodiversity	301
R. E. RICKLEFS	

PART 4

Temporal patterns of biodiversity	329
12 Latitudinal gradients of biodiversity: pattern, process, scale, and synthesis	331
M. R. WILLIG, D. M. KAUFMAN AND R. D. STEVENS	
13 Diversification and extinction in the history of life	375
M. J. BENTON	
14 Prehistoric extinctions of Pacific island birds – biodiversity meets zooarchaeology	396
D. W. STEADMAN	
15 Lessons from the past: biotic recoveries from mass extinctions	419
D. H. ERWIN	
16 Late Quaternary extinctions: state of the debate	433
P. L. KOCH AND A. D. BARNOSKY	

PART 5

Conservation genetics	473
 17 When does conservation genetics matter?	 475
W. AMOS AND A. BALMFORD	
 18 Inbreeding depression in conservation biology	 494
P. W. HEDRICK AND S. T. KALINOWSKI	
 19 The alluring simplicity and complex reality of genetic rescue	 520
D. A. TALLMON, G. LUIKART AND R. S. WAPLES	

PART 6

Key concepts	539
 20 Directions in conservation biology	 541
G. CAUGHLEY	
 21 Risks of population extinction from demographic and environmental stochasticity and random catastrophes	 601
R. LANDE	
 22 Scale and species richness: towards a general, hierarchical theory of species diversity	 621
R. J. WHITTAKER, K. J. WILLIS AND R. FIELD	
 23 The keystone-species concept in ecology and conservation	 655
L. S. MILLS, M. E. SOULÉ AND D. F. DOAK	

PART 7

The value of biodiversity	667
 24 The value of biodiversity	 669
P. R. EHRLICH AND A. H. EHRLICH	
 25 The value of the world's ecosystem services and natural capital	 690
R. COSTANZA, R. D'ARGE, R. DE GROOT, S. FARBER, M. GRASSO, B. HANNON, K. LIMBURG, S. NAEEM, R. V. O'NEILL, J. PARUELO, R. G. RASKIN, P. SUTTON AND M. VAN DEN BELT	

26	Values-led conservation	709
	P. JEPSON AND S. CANNEY	

VOLUME II CAUSES AND CONSEQUENCES OF BIODIVERSITY LOSS 1: DEVELOPMENT, HABITAT LOSS AND INVASIVE SPECIES

<i>Acknowledgements</i>	vii
-------------------------	-----

PART 8

Ultimate causes	1
-----------------	---

27	A review of the relationships between human population density and biodiversity	3
	G. W. LUCK	
28	Effects of human activity on global extinction risk	70
	J. T. KERR AND D. J. CURRIE	
29	Effects of exurban development on biodiversity: patterns, mechanisms, and research needs	89
	A. J. HANSEN, R. L. KNIGHT, J. M. MARZLUFF, S. POWELL, K. BROWN, P. H. GUDE AND K. JONES	
30	Urbanization, biodiversity, and conservation	115
	M. L. MCKINNEY	

PART 9

Habitat loss	133
--------------	-----

31	How much habitat is enough?	135
	L. FAHRIG	
32	Catastrophic extinctions follow deforestation in Singapore	153
	B. W. BROOK, N. S. SODHI AND P. K. L. NG	
33	Habitat loss and population decline: a meta-analysis of the patch size effect	163
	D. J. BENDER, T. J. CONTRERAS AND L. FAHRIG	

PART 10

Habitat fragmentation 193

- 34 Effects of habitat fragmentation on biodiversity 195

L. FAHRIG

- 35 Fragmentation effects on forest birds: relative influence of woodland cover and configuration on landscape occupancy 227

M.-A. VILLARD, M. K. TRZCINSKI AND G. MERRIAM

- 36 Confounding factors in the detection of species responses to habitat fragmentation 245

R. M. EWERS AND R. K. DIDHAM

- 37 Ecological responses to habitat edges: mechanisms, models, and variability explained 297

L. RIES, R. J. FLETCHER, J. BATTIN AND T. D. SISK

PART 11

Invasive species 333

- 38 Biotic homogenization: a few winners replacing many losers in the next mass extinction 335

M. L. MCKINNEY AND J. L. LOCKWOOD

- 39 Mammal invaders on islands: impact, control and control impact 344

F. COURCHAMP, J. L. CHAPUIS AND M. PASCAL

- 40 The invasion paradox: reconciling pattern and process in species invasions 407

J. D. FRIDLEY, J. J. STACHOWICZ, S. NAEEM, D. F. SAX,
E. W. SEABLOOM, M. D. SMITH, T. J. STOHLGREN,
D. TILMAN AND B. VON HOLLE

- 41 Are invasive species a major cause of extinctions? 436

J. GUREVITCH AND D. K. PADILLA

**VOLUME III CAUSES AND CONSEQUENCES
OF BIODIVERSITY LOSS 2: POLLUTION, CLIMATE
CHANGE AND UNSUSTAINABLE EXPLOITATION**

Acknowledgements

ix

PART 12

Pollution

1

- 42 The sinking ark: pollution and the worldwide loss
of biodiversity**

3

J. A. MCNEELY

- 43 The impact of insecticides and herbicides on the biodiversity
and productivity of aquatic communities**

23

R. A. RELYEA

- 44 The globalization of nitrogen deposition: consequences for
terrestrial ecosystems**

44

P. MATSON, K. A. LOHSE AND S. J. HALL

- 45 Ultraviolet radiation, toxic chemicals and amphibian
population declines**

64

A. R. BLAUSTEIN, J. M. ROMANSIC, J. M. KIESECKER
AND A. C. HATCH

PART 13

Climate change

91

- 46 Biological consequences of global warming: is the signal
already apparent?**

93

L. HUGHES

- 47 Extinction risk from climate change**

107

C. D. THOMAS, A. CAMERON, R. E. GREEN, M. BAKKENES,
L. J. BEAUMONT, Y. C. COLLINGHAM, B. F. N. ERASMUS,
M. F. DE SIQUEIRA, A. GRAINGER, L. HANNAH, L. HUGHES,
B. HUNTLEY, A. S. VAN JAARSVELD, G. F. MIDGLEY,
L. J. MILES, M. A. ORTEGA-HUERTA, A. TOWNSEND PETERSON,
O. L. PHILLIPS AND S. E. WILLIAMS

48	Forecasting the effects of global warming on biodiversity	119
	D. B. BOTKIN, H. SAXE, M. B. ARAUJO, R. BETTS, R. H. W. BRADSHAW, T. CEDHAGEN, P. CHESSON, T. P. DAWSON, J. R. ETTERSON, D. P. FAITH, S. FERRIER, A. GUISAN, A. S. HANSEN, D. W. HILBERT, C. LOEHLE, C. MARGULES, M. NEW, M. J. SOBEL AND D. R. B. STOCKWELL	
49	Global biodiversity scenarios for the year 2100	139
	O. E. SALA, F. S. CHAPIN, J. J. ARMESTO, E. BERLOW, J. BLOOMFIELD, R. DIRZO, E. HUBER-SANWALD, L. F. HUENNEKE, R. B. JACKSON, A. KINZIG, R. LEEMANS, D. M. LODGE, H. A. MOONEY, M. OESTERHELD, N. L. POFF, M. T. SYKES, B. H. WALKER, M. WALKER AND D. H. WALL	
PART 14		
	Unsustainable exploitation	155
50	The myriad consequences of hunting for vertebrates and plants in tropical forests	157
	S. J. WRIGHT	
51	Wild meat: the bigger picture	183
	E. J. MILLNER-GULLAND AND E. L. BENNETT	
52	Synergistic effects of subsistence hunting and habitat fragmentation on Amazonian forest vertebrates	200
	C. A. PERES	
53	Fishing down marine food webs	231
	D. PAULY, V. CHRISTENSEN, J. DALSGAARD, R. FROESE AND F. TORRES	
PART 15		
	Threatened ecosystems	241
54	Deforestation in Brazilian Amazonia: history, rates, and consequences	243
	P. M. FEARNSIDE	

CONTENTS

55	Freshwater biodiversity: importance, threats, status and conservation challenges	259
	D. DUDGEON, A. H. ARTHINGTON, M. O. GESSNER, Z. I. KAWABATA, D. J. KNOWLER, C. LEVEQUE, R. J. NAIMAN, A. H. PRIEUR-RICHARD, D. SOTO, M. L. J. STIASSNY AND C. A. SULLIVAN	
56	Threats to the running water ecosystems of the world	296
	B. MALMQVIST AND S. RUNDLE	
57	Marine biodiversity: patterns, threats and conservation needs	337
	J. S. GRAY	
58	Evaluating and ranking the vulnerability of global marine ecosystems to anthropogenic threats	365
	B. S. HALPERN, K. A. SELKOE, F. MICHELI AND C. V. KAPPEL	
59	Climate change, coral bleaching and the future of the world's coral reefs	391
	O. HOEGH-GULDBERG	
60	The global conservation status of mangroves	447
	E. J. FARNSWORTH AND A. M. ELLISON	
61	A global crisis for seagrass ecosystems	464
	R. J. ORTH, T. J. B. CARRUTHERS, W. C. DENNISON, C. M. DUARTE, J. W. FOURQUREAN, K. L. HECK, A. R. HUGHES, G. A. KENDRICK, W. J. KENWORTHY, S. OLYARNIK, F. T. SHORT, M. WAYCOTT AND S. L. WILLIAMS	

VOLUME IV RESPONSES TO BIODIVERSITY LOSS

<i>Acknowledgements</i>	xi
-------------------------	----

PART 16

International legal framework	1
62 The UN Convention on biodiversity	3
63 Why is there a biodiversity convention? The international interest in centralized development planning	31
T. SWANSON	

64	The 2010 challenge: data availability, information needs and extraterrestrial insights	58
	A. BALMFORD, P. CRANE, A. DOBSON, R. E. GREEN AND G. M. MACE	
PART 17		
	Protected areas and protected area networks	75
65	What do genetics and ecology tell us about the design of nature reserves?	77
	M. E. SOULE AND D. SIMBERLOFF	
66	Rethinking protected area categories and the new paradigm	96
	H. LOCKE AND P. DEARDEN	
67	Extinction in nature reserves: the effect of fragmentation and the importance of migration between reserve fragments	116
	T. V. BURKEY	
68	Design of reserve networks and the persistence of biodiversity	130
	M. CABEZA AND A. MOILANEN	
69	Global gap analysis: priority regions for expanding the global protected-area network	145
	A. S. L. RODRIGUES, H. R. AKCAKAYA, S. J. ANDELMAN, M. I. BAKARR, L. BOITANI, T. M. BROOKS, J. S. CHANSON, L. D. C. FISHPOOL, G. A. B. DA FONSECA, K. J. GASTON, M. HOFFMANN, P. A. MARQUET, J. D. PILGRIM, R. L. PRESSEY, J. SCHIPPER, W. SECHREST, S. N. STUART, L. G. UNDERHILL, R. W. WAILER, M. E. J. WATTS AND X. YAN	
PART 18		
	Conservation planning	163
70	Beyond opportunism: key principles for systematic reserve selection	165
	R. L. PRESSEY, C. J. HUMPHRIES, C. R. MARGULES, R. I. VANE-WRIGHT AND P. H. WILLIAMS	
71	Systematic conservation planning	177
	C. R. MARGULES AND R. L. PRESSEY	

72	Biodiversity hotspots for conservation priorities	207
	N. MYERS, R. A. MITTERMEIER, C. G. MITTERMEIER, G. A. B. DA FONSECA, AND J. KENT	
73	The global 200: a representation approach to conserving the Earth's most biologically valuable ecoregions	224
	D. M. OLSEN AND E. DINERSTEIN	
74	Conserving biodiversity efficiently: what to do, where, and when	250
	K. A. WILSON, E. C. UNDERWOOD, S. A. MORRISON, K. R. KLAUSMEYER, W. W. MURDOCH, B. REYERS, G. WARDELL-JOHNSON, P. A. MARQUET, P. W. RUNDEL, M. F. MCBRIDE, R. L. PRESSEY, M. BODE, J. M. HOEKSTRA, S. ANDELMAN, M. LOOKER, C. RONDININI, P. KAREIVA, M. R. SHAW AND H. P. POSSINGHAM	
75	Climate change-integrated conservation strategies	275
	L. HANNAH, G. F. MIDGLEY AND D. MILLAR	
PART 19		
	Identifying threats	297
76	Assessing extinction threats: toward a re-evaluation of IUCN threatened species categories	299
	G. M. MACE AND R. LANDE	
77	An evaluation of threatened species categorization systems used on the American continent	315
	P. C. DE GRAMMONT AND A. D. CUARON	
78	Making consistent IUCN classifications under uncertainty	340
	H. R. AKCAKAYA, S. FERSON, M. A. BURGMAN, D. A. KEITH, G. M. MACE AND C. R. TODD	
79	Inferring threat from scientific collections	364
	M. A. BURGMAN, R. C. GRIMSON AND S. FERSON	
PART 20		
	Restoration and re-wilding	375
80	Restoration ecology: repairing the Earth's ecosystems in the new millennium	377
	R. J. HOBBS AND J. A. HARRIS	

CONTENTS

81	Restoration ecology and conservation biology	392
	T. P. YOUNG	
82	Alternative states and positive feedbacks in restoration ecology	413
	K. N. SUDING, K. L. GROSS AND G. R. HOUSEMAN	
83	Defining the limits of restoration: the need for realistic goals	431
	J. G. EHRENFIELD	
84	Pleistocene rewilding: an optimistic agenda for twenty-first century conservation	447
	C. J. DONLAN, J. BERGER, C. E. BOCK, J. H. BOCK, D. A. BURNEY, J. A. ESTES, D. FOREMAN, P. S. MARTIN, G. W. ROEMER, F. A. SMITH, M. E. SOULÉ, H. W. GREENE	
PART 21		
	Translocations and introductions	487
85	Reintroduction: challenges and lessons for basic ecology	489
	F. SARRAZIN AND R. BARBAULT	
86	Developing the science of reintroduction biology	501
	P. J. SEDDON, D. P. ARMSTRONG AND R. F. MALONEY	
87	Translocation as a species conservation tool: status and strategy	519
	B. GRIFFITH, J. M. SCOTT, J. W. CARPENTER AND C. REED	
PART 22		
	Ex-situ conservation	529
88	Designing the ark: setting priorities for captive breeding	531
	A. BALMFORD, G. M. MACE AND N. LEADER-WILLIAMS	
89	Linking wild and captive populations to maximize species persistence: optimal translocation strategies	547
	B. TENHUMBERG, A. J. TYRE, K. SHEA AND H. P. POSSINGHAM	
90	Keeping fit on the ark: assessing the suitability of captive-bred animals for release	568
	F. MATHEWS, M. ORROS, G. MCLAREN, M. GELLING AND R. FOSTER	

PART 23

Conservation practice	585
91 Biological vs. social, economic and political priority-setting in conservation	587
C. O'CONNOR, M. MARVIER AND P. KAREIVA	
92 Governance and the loss of biodiversity	597
R. J. SMITH, R. D. J. MUIR, M. J. WALPOLE, A. BALMFORD AND N. LEADER-WILLIAMS	
93 Conserving tropical biodiversity amid weak institutions	606
C. B. BARRETT, K. BRANDON, C. GIBSON AND H. GJERTSEN	
94 Gaps and mismatches between global conservation priorities and spending	618
B. S. HALPERN, C. R. PYKE, H. E. FOX, J. C. HANEY, M. A. SCHLAEPFER AND P. ZARADIC	

PART 24

Community conservation	633
95 Community-based conservation in a globalized world	635
F. BERKES	
96 Community conservation and the future of Africa's wildlife	651
J. D. HACKEL	
97 When agendas collide: human welfare and biological conservation	668
K. M. A. CHAN, R. M. PRINGLE, J. RANGANATHAN, C. L. BOGGS, Y. L. CHAN, P. R. EHRLICH, P. K. HAFF, N. E. HELLER, K. AL-KHAFAJI AND D. P. MACMYNOWSKI	

VOLUME V FUTURE DIRECTIONS IN BIODIVERSITY CONSERVATION

Acknowledgements ix

PART 25

Lessons from the past 1

- 98 How can a knowledge of the past help to conserve the future?
Biodiversity conservation and the relevance of long-term
ecological studies 3

K. J. WILLIS, M. B. ARAUJO, K. D. BENNETT,
B. FIGUEROA-RANGEL, C. A. FROYD AND N. MYERS

- 99 Tropical forest recovery: legacies of human impact and
natural disturbances 26

R. L. CHAZDON

- 100 Applied historical ecology: using the past to manage
for the future 63

T. W. SWETNAM, C. D. ALLEN AND J. L. BETANCOURT

PART 26

Predicting the future of biodiversity 95

- 101 Forecasting global biodiversity threats associated with
human population growth 97

J. K. MCKEE, P. W. SCIULLI, C. D. FOOTE AND T. A. WAITE

- 102 Predicting biodiversity change: outside the climate
envelope, beyond the species-area curve 105

I. IBANEZ, J. S. CLARK, M. C. DIETZE, K. FEELEY,
M. HERSH, S. LADEAU, A. MCBRIDE, N. E. WELCH
AND M. S. WOLOSIN

- 103 Estimating population spread: what can we forecast
and how well? 126

J. S. CLARK, M. LEWIS, J. S. MCLACHLAN AND
J. HILLERISLAMBERS

- 104 Is it meaningful to estimate a probability of extinction? 147

D. LUDWIG

105	Predicting global change impacts on plant species' distributions: future challenges	173
	W. THUILLER, C. ALBERT, M. B. ARAUJO, P. M. BERRY, M. CABEZA, A. GUISAN, T. HICKLER, G. F. MIDGLEY, J. PATERSON, F. M. SCHURR, M. T. SYKES AND N. E. ZIMMERMAN	
 PART 27		
	Conservation outside of protected areas	203
106	Reconciliation ecology and the future of species diversity	205
	M. L. ROSENZWEIG	
107	Conservation where people live and work	229
	J. R. MILLER AND R. J. HOBBS	
108	How effective are European agri-environment schemes in conserving and promoting biodiversity?	244
	D. KLEIJN AND W. J. SUTHERLAND	
 PART 28		
	The IT revolution and biodiversity science	283
109	The encyclopedia of life	285
	E. O. WILSON	
110	Automated species identification: why not?	293
	K. J. GASTON AND M. A. O'NEILL	
111	Information technology challenges of biodiversity and ecosystems informatics	320
	J. L. SCHNASE, J. CUSHING, M. FRAME, A. FRONDORF, E. LANDIS, D. MAIER AND A. SILBERSCHATZ	
 PART 29		
	Biodiversity, poverty and sustainable development	331
112	Parks and peoples: the social impact of protected areas	333
	P. WEST, J. IGOE AND D. BROCKINGTON	

113	Sustainable use and incentive-driven conservation: realigning human and conservation interests	365
	J. M. HUTTON AND N. LEADER-WILLIAMS	
114	A framework for improved monitoring of biodiversity: responses to the World Summit on Sustainable Development	386
	R. E. GREEN, A. BALMFORD, P. R. CRANE, G. M. MACE, J. D. REYNOLDS AND R. K. TURNER	
115	Innovations for conservation and development	403
	K. BROWN	

PART 30

Paying for biodiversity	423
--------------------------------	-----

116	Economic benefits of rare and endangered species: summary and meta-analysis	425
	J. B. LOOMIS AND D. S. WHITE	
117	Valuing biodiversity for use in pharmaceutical research	440
	R. D. SIMPSON, R. A. SEDJO AND J. W. REID	
118	Is community-based ecotourism a good use of biodiversity conservation funds?	462
	A. KISS	
119	The non-economic motives behind the willingness to pay for biodiversity conservation	475
	B. MARTIN-LOPEZ, C. MONTES AND J. BENAYAS	

PART 31

The future of biodiversity research and biodiversity conservation		503
120	Conservation biogeography: assessment and prospect	505
	R. J. WHITTAKER, M. B. ARAUJO, P. JEPSON, R. J. LADLE, J. E. M. WATSON AND K. J. WILLIS	
121	Extinction and the loss of evolutionary history	547
	S. NEE AND R. M. MAY	
122	Conservation biology and real-world conservation	556
	J. G. ROBINSON	

<i>Index</i>	579
--------------	-----