

Contents

Introduction	1
G.A. BRADSHAW, P.A. MARQUET	
1 Background	1
2 Why the Americas?	2
3 Why Ecosystem Fragmentation?	3
References	4

Part I Causes and Processes of Landscape Fragmentation

1 Biodiversity and Human Intervention	
During the Last 11,000 Years in North-Central Chile	7
L. NÚÑEZ, M. GROSJEAN	
1.1 Introduction	7
1.2 Principal Phases of Human–Environment Interaction	
in North-Central Chile	8
1.2.1 Biodiversity Changes	
at the Pleistocene–Holocene Transition	8
1.2.2 Camelid Domestication During the Mid-Holocene:	
the Rise of a New Human–Environment Interaction	11
1.2.3 The Transition from Mid-Holocene to Modern Climate:	
Pastoralism and Agricultural Changes	12
1.2.4 Changes During the Historic Period	
(16th–20th Centuries)	13
References	16

2	Beyond Malthus and Perverse Incentives: Economic Globalization, Forest Conversion and Habitat Fragmentation	19
	S.F. SIEBERT	
2.1	Introduction	19
2.2	Demographic Pressures	20
2.3	Perverse Incentives and Market Failures	21
2.4	Economic Globalization	23
2.5	The Case of Chiapas	24
2.6	Chile – The Model of Economic Liberalization	26
2.7	Economic Globalization Effects on Forest Conversion and Habitat Fragmentation	27
2.8	Conclusion	29
	References	30
 3	 Forest Fragmentation and Biodiversity in Central Amazonia	 33
	C. GASCON, W.F. LAURANCE, T.E. LOVEJOY	
3.1	Introduction	33
3.2	Forest Fragmentation and Theory	33
3.3	Biological Dynamics of Forest Fragments Project History and Study Sites	34
3.4	Ecological Consequences of Forest Fragmentation	36
3.4.1	Area and Insularization	36
3.4.2	Edge Creation	38
3.4.3	Matrix Habitat and Landscape Configuration	39
3.5	Forest Fragmentation and Land Management	41
	References	43
 4	 Climatic and Human Influences on Fire Regimes in Temperate Forest Ecosystems in North and South America	 49
	P. ALABACK, T.T. VEBLEN, C. WHITLOCK, A. LARA, T. KITZBERGER, R. VILLALBA	
4.1	Introduction	49
4.1.1	Overview of Climate	51

Contents	IX
4.1.2	Lightning 53
4.1.3	Vegetation Patterns 54
4.2	Relation of Climate to Fire Regimes 55
4.2.1	General Patterns 55
4.2.2	Overview of Fire Disturbance Patterns in Western North America 57
4.2.2.1	Yellowstone Region 59
4.2.2.2	Colorado Front Range 61
4.2.3	Current State of Knowledge for Northern Patagonia 62
4.3	Anthropogenic Influences on Fire Regimes – Land Use and Fire Regimes in the Rocky Mountain Region and Northern Patagonia 64
4.3.1	Native American Period 65
4.3.2	The Euro-American Settlement Phase 68
4.3.3	Modern Land-Use Period 69
4.4	Effects of Fire on Landscape Patterns 71
4.5	Summary 72
4.6	Research Needs 73
References	79

5 Natural Versus Anthropogenic Sources of Amazonian Biodiversity: the Continuing Quest for El Dorado 89
B.J. MEGGERS

5.1	Introduction 89
5.2	Significant Characteristics of the Amazonian Environment . 90
5.3	Evidence for Dense Pre-Columbian Populations 91
5.3.1	Botanical Evidence 91
5.3.2	Ethnohistorical Evidence 93
5.3.3	Archeological Evidence 96
5.3.3.1	Earthworks 96
5.3.3.2	Habitation Sites 98
5.3.4	Ethnographic Evidence 99
5.4	Conclusions 102
References	103

Part II Ecological and Evolutionary Consequences of Fragmentation

6	Bees Not to Be? Responses of Insect Pollinator Faunas and Flower Pollination to Habitat Fragmentation	111
	M.A. AIZEN, P. FEINSINGER	
6.1	Introduction	111
6.2	Patterns of Change in Pollinator Faunas Due to Habitat Fragmentation	112
6.3	Mechanisms and Processes Behind Changes in Pollinator Faunas	115
6.4	Scale Considerations	117
6.5	Pollination and Habitat Fragmentation	119
6.6	Concluding Remarks and Research Needs	122
	References	124
7	Implications of Evolutionary and Ecological Dynamics to the Genetic Analysis of Fragmentation	131
	L. JOSEPH, M. CUNNINGHAM, S. SARRE	
7.1	Introduction	131
7.2	Post-Fragmentation. A Comparison of Fragmentation Genetics in the Western Australian Wheat Belt and the Rainforests of the Wet Tropics	132
7.2.1	Study Areas	132
7.2.2	Study Species	133
7.2.3	Methodology	134
7.2.4	Results	135
7.3	Pre-Fragmentation. An Alternative Perspective on Genetic Structure of Natural Populations	138
7.3.1	Three Sympatric Amazonian Rodents: Contrasting Genetic Structures	139
7.3.2	Yellow-Footed Rock Wallabies: a Naturally Patchily Distributed Species	140
7.3.3	<i>Eucalyptus argutifolia</i> : Clonal Reproduction and Fragmentation	140
7.4	A Final Theoretical Consideration	141
7.5	Conclusion	142
	References	143

8	Forest Fragmentation, Plant Regeneration and Invasion Processes Across Edges in Central Chile . . .	145
	R.O. BUSTAMANTE, I.A. SEREY, S.T.A. PICKETT	
8.1	Introduction	145
8.2	Edge Effect and the Invasion of <i>Pinus radiata</i> into Temperate Forests of Central Chile	146
8.3	Results	149
8.4	Discussion	150
8.5	A Graphic Model	151
8.6	Model Application	154
8.6.1	Recruitment of Native Trees	154
8.6.2	Recruitment of Monterrey Pine	155
8.7	General Conclusions	156
8.8	Appendix	157
	References	158
 9	 The Ecological Consequences of a Fragmentation-Mediated Invasion: The Argentine Ant, <i>Linepithema humile</i>, in Southern California	 161
	A.V. SUAREZ, T.J. CASE	
9.1	Introduction	161
9.2	Methods	163
9.2.1	Ant Communities of Coastal Scrub Fragments in Southern California	163
9.2.2	The Effects of Argentine Ants on Coastal Horned Lizard Diet	165
9.3	Results	167
9.3.1	Ant Communities of Coastal Scrub Fragments in Southern California	167
9.3.2	The Effects of Argentine Ants on Coastal Horned Lizard Diet	172
9.4	Discussion	174
9.4.1	Local Extinction of Native Ground-Foraging Ants	174
9.4.2	Diet and Prey Preference in Coastal Horned Lizards	176
9.5	Conclusions and Implications for Reserve Management . .	177
	References	178

**Part III Ecosystem Fragmentation: Theory, Methods,
and Implications for Conservation**

10	A Review and Synthesis of Conceptual Frameworks for the Study of Forest Fragmentation	183
	G.H. KATTAN, C. MURCIA	
10.1	Introduction	183
10.2	Evolution of Studies on the Effects of Forest Fragmentation: Empirical Evidence and Conceptual Frameworks	185
10.3	A Comprehensive Framework	188
10.3.1	The Process of Fragmentation	188
10.3.2	Effects of Fragmentation on Animal Populations	190
10.4	Framing the Evidence	195
	References	197
 11	 Reflections on Landscape Experiments and Ecological Theory: Tools for the Study of Habitat Fragmentation . . .	 201
	R.D. HOLT, D.M. DEBINSKI	
11.1	Introduction	201
11.2	Theoretical Context	203
11.2.1	Area Effects	203
11.2.2	Dispersal Effects	204
11.2.3	Heterogeneous Landscape Effects	205
11.2.4	Interspecific Interaction and Food Web Effects	206
11.3	What Is a Fragmentation Experiment?	208
11.4	Why Do Experiments on Fragmentation?	208
11.5	A Global Survey of Fragmentation Experiments	210
11.6	A Case Study: The Kansas Experimentally Fragmented Landscape	212
11.6.1	Core Findings, 1985–1990	214
11.6.2	Core Findings, 1991–Present	214
11.7	Limitations in Experimental Fragmentation Studies	215
11.8	Conclusions	217
	References	218

12	Spatial Autocorrelation, Dispersal and the Maintenance of Source-Sink Populations	225
	T.H. KEITT	
12.1	Introduction	225
12.2	Spatial Autocorrelation	226
12.3	Models and Methods	227
12.3.1	Population Processes	227
12.3.2	Landscape Model	228
12.3.3	Dispersal Model	230
12.3.4	Modeling Scenarios	231
12.4	Results and Discussion	231
12.5	Management Implications	233
12.6	Appendix A: Mathematical Models	234
12.6.1	Fractal Landscapes	234
12.6.2	Stochastic Landscape Networks	235
12.7	Appendix B: Statistical Analysis and Results	237
	References	238
 13	 Patch Dynamics, Habitat Degradation and Space in Metapopulations	 239
	P.A. MARQUET, J.X. VELASCO-HERNÁNDEZ, J.E. KEYMER	
13.1	Introduction	239
13.2	Levins' Original Model	240
13.3	Incorporating Patch Dynamics and Habitat Degradation (Model 2)	241
13.4	The Invasion Threshold	243
13.5	The Threshold Parameter in Levins' Metapopulation Model	244
13.6	Threshold Parameters for Model 2	244
13.7	A Spatially Explicit Metapopulation Model	247
13.8	Spatial Habitat Dynamics	249
13.9	The Interaction Between Metapopulation Dynamics and Habitat Dynamics	251
	References	253

14	How Much Functional Redundancy Is Out There, or, Are We Willing to Do Away with Potential Backup Species?	255
	F.M. JAKSIC	
14.1	The Issue	255
14.2	Soft Evidence for Redundancy	255
14.3	Somewhat Harder Evidence for Redundancy	256
14.4	How Will We Know What Is Redundant?	259
14.5	What If Backup Species Are Necessary for Ecosystem Persistence?	260
	References	261
 15	 Predicting Distributions of South American Migrant Birds in Fragmented Environments: A Possible Approach Based on Climate	 263
	L. JOSEPH	
15.1	Introduction	263
15.2	Methods	265
15.3	Results	272
15.3.1	<i>Sterna maxima</i>	272
15.3.2	<i>Colorhamphus parvirostris</i>	274
15.3.3	<i>Serpophaga griseiceps</i>	274
15.3.4	<i>Myiarchus swainsoni swainsoni</i> and <i>Myiarchus swainsoni ferocior</i>	275
15.3.5	<i>Elaenia strepera</i>	275
15.3.6	<i>Elaenia chiriquensis albivertex</i>	275
15.3.7	<i>Sporophila lineola</i>	276
15.3.8	<i>Elaenia albiceps chilensis</i>	276
15.4	Discussion	278
	References	281
 16	 Habitat Heterogeneity on a Forest-Savanna Ecotone in Noel Kempff Mercado National Park (Santa Cruz, Bolivia): Implications for the Long-Term Conservation of Biodiversity in a Changing Climate	 285
	T.J. KILLEEN, T.M. SILES, T. GRIMWOOD, L.L. TIESZEN, M.K. STEININGER, C.J. TUCKER, S. PANFIL	
16.1	Introduction	285
16.2	Climatic Stress	291

16.3	Geomorphology	292
16.4	Fire	297
16.5	Flooding	299
16.6	Succession on the Savanna-Forest Interface	300
16.7	Direct Evidence for Past Climate Change	302
16.8	Conservation Issues	308
	References	310

17

**Bandages for Wounded Landscapes: Faunal Corridors
and Their Role in Wildlife Conservation in the Americas . .**

313

S.G.W. LAURANCE, W.F. LAURANCE

17.1	Introduction	313
17.2	Considerations in Corridor Design	314
17.2.1	Corridor Width	314
17.2.2	Corridor Length	316
17.2.3	Faunal Stepping Stones	317
17.2.4	Primary Versus Secondary Habitat	317
17.2.5	Topographic Position	317
17.2.6	Nonterrestrial Corridors	318
17.3	Design and Management of Faunal Corridors	318
17.3.1	Conclusions About Corridor Effectiveness	318
17.3.2	Guidelines and Principles for Corridor Design	319
17.3.3	Proactive Landscape Management	320
	References	321

18

Management of the Semi-Natural Matrix

327

J.H. BROWN, C.G. CURTIN, R.W. BRAITHWAITE

18.1	Introduction	327
18.2	Definition	327
18.3	Land Area and Use	329
18.4	Role in Conservation	330
18.5	Case Study: Temperate Ecosystems – Conflicts Between Traditional Conservation Goals and Management of the Matrix	331
18.6	Management Goals and Methods	336
18.7	Priorities	338
18.8	Concluding Remarks	339
	References	340

Human Disturbance and Ecosystem Fragmentation in the Americas
Synthesis and Final Reflections 345
P.A. MARQUET, G.A. BRADSHAW

How Landscapes Change: The Need of a Framework
for Understanding 345
Humans and Landscape Changes in the Americas:
A Plea for Integration 348
Fragmentation in the Americas: On the Road to Ecosystem Disruption? 350
What to do next 351
References 352

Subject Index 355