
Contents

List of Contributors	xii
Introduction	1
<i>Jari Niemelä, Jürgen Breuste, Thomas Elmqvist, Glenn Guntenspergen, Philip James, and Nancy McIntyre</i>	
The History of Urban Ecology—An Ecologist's Perspective	5
<i>Mark J. McDonnell</i>	
Introduction	5
Emergence of the discipline of urban ecology	5
The science of urban ecology	9
Summary	12
Section 1—Ecology in Cities: Man-Made Physical Conditions	15
Introduction	17
<i>Jürgen H. Breuste</i>	
1.1 Land-Use and Surface-Cover as Urban Ecological Indicators	19
<i>Stephan Pauleit and Jürgen H. Breuste</i>	
1.1.1 Introduction: urban form and ecosystem processes	19
1.1.2 Land-use and surface-cover patterns in urban area	20
1.1.3 Land-use and surface-cover dynamics in urban areas and their ecological implications	26
1.1.4 Conclusions	29
1.2 Urban Climate	31
<i>Eberhard Parlow</i>	
1.2.1 Introduction	31
1.2.2 Physical aspects of urban climate	31
1.2.3 The urban heat island phenomenon	34
1.2.4 Biological aspects of urban climate	38
1.2.5 Chemical aspects of urban climate	38
1.2.6 Impacts of urban climate on human health	40
1.2.7 Conclusions	43
1.3 Urban Soils—Characterization, Pollution, and Relevance in Urban Ecosystems	45
<i>Martin Sauerwein</i>	
1.3.1 Introduction—what are urban soils?	45
1.3.2 Pollution of urban soils	47

1.3.3	Properties of urban soils	50
1.3.4	Genesis of urban soils and soil functions in urban ecosystems	52
1.3.5	Urban soil landscapes	54
1.3.6	Balancing the soil substance budget in settlements	56
1.3.7	Classification of soils in settlements	56
1.3.8	Urban soil protection concepts	57
1.4	Hydrology of Urban Environments	59
	<i>Marc Illgen</i>	
1.4.1	Introduction	59
1.4.2	Urban water cycle	59
1.4.3	Hydrological processes in urban areas	61
1.4.4	Water balance characteristics of urban areas	69
	Summary	71
	<i>Jürgen H. Breuste</i>	
	Section 2—Ecology in Cities: Patterns of Urban Biodiversity	73
	Introduction	75
	<i>Glenn R. Guntenspergen</i>	
2.1	Plant Communities of Urban Wetlands: Patterns and Controlling Processes	77
	<i>Andrew H. Baldwin</i>	
2.1.1	Introduction	77
2.1.2	Wetland plant biodiversity in urban areas	78
2.1.3	Effects of urbanization on wetland vegetation	80
2.1.4	Synthesis and prospective view	84
2.2	Potemkin Gardens: Biodiversity in Small Designed Landscapes	85
	<i>Martin F. Quigley</i>	
2.2.1	Introduction	85
2.2.2	Species diversity	85
2.2.3	Structural biodiversity	86
2.2.4	Design	88
2.2.5	Conclusion	91
2.3	Vegetation of Urban Hard Surfaces	93
	<i>Jeremy Lundholm</i>	
2.3.1	Introduction	93
2.3.2	Hard surface types	93
2.3.3	Biota	97
2.3.4	Colonization and dynamics	98
2.3.5	Origin of hard surface floras	99
2.3.6	Theoretical frameworks	100
2.3.7	Problems caused by vegetation on hard surfaces	101
2.3.8	Benefits of hard surface vegetation	102

2.4	Composition and Diversity of Urban Vegetation	103
	<i>Christopher P. Dunn and Liam Heneghan</i>	
2.4.1	Introduction	103
2.4.2	Urban floristics	104
2.4.3	Does size matter? Cities and vegetation patches as habitat islands	106
2.4.4	The planted cityscape	108
2.4.5	Ecology of remnant vegetation in urban areas	111
2.4.6	Drivers of biodiversity and change in urban vegetation	113
2.4.7	Looking ahead	114
2.5	Anthropogenic Ecosystems: The Influence of People on Urban Wildlife Populations	116
	<i>Clark E. Adams and Kieran J. Lindsey</i>	
2.5.1	Introduction	116
2.5.2	Definitions of 'urban' on a global scale	116
2.5.3	Humans as a keystone species	117
2.5.4	Assemblages of urban vertebrates worldwide	118
2.5.5	Similarities and differences in urban vertebrate assemblages	120
2.5.6	Managing wildlife in anthropogenic ecosystems	120
2.5.7	Required adaptations to exist and thrive in urban ecosystems	121
2.5.8	The built environment as hazard and habitat	121
2.5.9	Wildlife assemblages in a city without people	127
2.5.10	Anthropogenic ecosystems: are humans key?	128
	Summary	129
	<i>Glenn R. Guntenspergen</i>	
Section 3	Ecology in Cities: Processes Affecting Urban Biodiversity	131
	Introduction	133
	<i>Nancy E. McIntyre</i>	
3.1	Coupled Relationships between Humans and other Organisms in Urban Areas	135
	<i>Barbara Clucas and John M. Marzluff</i>	
3.1.1	Introduction	135
3.1.2	Humans and natural systems	136
3.1.3	Interactions between humans and other organisms	137
3.1.4	Coevolution of humans and animals	138
3.1.5	Humans and birds in urban areas	138
3.1.6	Conclusions	147
3.2	Urban Flora and Vegetation: Patterns and Processes	148
	<i>Sarel S. Cilliers and Stefan J. Siebert</i>	
3.2.1	Introduction	148
3.2.2	Urban vegetation: definitions and the current state of research	149
3.2.3	Processes affecting plant diversity patterns	150
3.2.4	Conclusions	157

3.3 Effects of Urbanization on the Ecology and Evolution of Arthropods	159
<i>Johan Kotze, Stephen Venn, Jari Niemelä, and John Spence</i>	
3.3.1 Introduction	159
3.3.2 Arthropods in the fragmented urban landscape	159
3.3.3 The urban–rural gradient	160
3.3.4 Unique urban habitats	162
3.3.5 Arthropod adaptation to urban environments	164
3.3.6 Arthropod conservation in urban environments	165
3.3.7 Future research	166
3.4 Ecology of Urban Amphibians and Reptiles: Urbanophiles, Urbanophobes, and the Urbanoblivious	167
<i>Bruce W. Grant, George Middendorf, Michael J. Colgan, Haseeb Ahmad, and Michael B. Vogel</i>	
3.4.1 Introduction	167
3.4.2 Herps in cities	171
3.4.3 Herps of cities	175
3.4.4 Urban herps as indicators	176
3.4.5 Urban herps as educators	177
3.4.6 Concluding comments	178
3.5 Biodiversity and Community Composition in Urban Ecosystems: Coupled Human, Spatial, and Metacommunity Processes	179
<i>Christopher M. Swan, Steward T. A. Pickett, Katalin Szlavecz, Paige Warren, and K. Tara Willey</i>	
3.5.1 Introduction	179
3.5.2 Constraints on metacommunity properties in urban systems	180
3.5.3 Social dimensions of biodiversity in urban ecosystems	181
3.5.4 Urban metacommunity properties	182
3.5.5 A conceptual model of urban metacommunities	184
3.5.6 Conclusions	186
Summary	187
<i>Nancy E. McIntyre</i>	
Section 4—Ecosystems, Ecosystem Services, and Social Systems in Urban Landscapes	189
Introduction	191
<i>Thomas Elmquist</i>	
4.1 Global Effects of Urbanization on Ecosystem Services	193
<i>Robert McDonald and Peter Marcotullio</i>	
4.1.1 Introduction	193
4.1.2 What is the alternative to urbanization?	193
4.1.3 The urban–environmental transition	195
4.1.4 Ecosystem services	197
4.1.5 Conclusions	204

4.2 Social-Ecological Transformations in Urban Landscapes—A Historical Perspective	206
<i>Charles L. Redman</i>	
4.2.1 Introduction	206
4.2.2 Why look to the past?	206
4.2.3 Drivers and consequences of urbanization through history	208
4.2.4 Towards an understanding of urban resilience	211
4.3 The Urban Landscape as a Social-Ecological System for Governance of Ecosystem Services	213
<i>Christine Alfsen, Ashley Duval, and Thomas Elmqvist</i>	
4.3.1 Introduction	213
4.3.2 Urban ecosystems and ecosystem services	214
4.3.3 Governance of urban ecosystems	215
4.4 Water Services in Urban Landscapes	219
<i>Peter Bridgewater</i>	
4.4.1 Introduction	219
4.4.2 Wetlands and water in the urban environment	221
4.4.3 Ecohydrology	223
4.4.4 Healthy wetlands, healthy people	224
4.4.5 Future research directions	226
4.5 The Role of Ecosystem Services in Contemporary Urban Planning	228
<i>Johan Colding</i>	
4.5.1 Introduction	228
4.5.2 Urban sprawl and ecosystem services	229
4.5.3 Green infrastructure planning	229
4.5.4 Smart growth planning	231
4.5.5 Generation of urban ecosystem services	232
4.5.6 The simplification of the urban landscape	232
4.5.7 Implications of smart growth and green infrastructure planning	234
4.5.8 The pedagogic role of nature in cities	236
4.5.9 Concluding remarks	236
Summary	238
<i>Thomas Elmqvist</i>	
Section 5—Urban Design, Planning, and Management: Lessons from Ecology	241
Introduction	243
<i>Philip James</i>	
5.1 Urban Ecology—The Bigger Picture	246
<i>Ian Douglas and Joe Ravetz</i>	
5.1.1 Introduction	246
5.1.2 A wider framework	246

5.1.3	Social and cultural issues	248
5.1.4	Ecological planning and investment	257
5.1.5	Conclusions	262
5.2	Urban Ecology and Human Health	263
	<i>Konstantinos Tzoulas and Kim Greening</i>	
5.2.1	Introduction	263
5.2.2	Urban ecology and physical health	265
5.2.3	Urban ecology and psychological well-being	267
5.2.4	Urban ecology and social well-being	268
5.2.5	Summary and conclusions	271
5.3	Multifunctional Green Infrastructure Planning to Promote Ecological Services in the City	272
	<i>Stephan Pauleit, Li Liu, Jack Ahern, and Aleksandra Kazmierczak</i>	
5.3.1	Introduction: green infrastructure	272
5.3.2	Concepts and principles of green infrastructure planning	273
5.3.3	Green infrastructure planning in practice	275
5.3.4	Conclusions	284
5.4	Building for Biodiversity: Accommodating People and Wildlife in Cities	286
	<i>Jon Sadler, Adam Bates, Rossa Donovan, and Stefan Bodnar</i>	
5.4.1	Introduction	286
5.4.2	Managing urban systems	287
5.4.3	Planning tools and approaches to urban planning—a UK perspective	287
5.4.4	Building and managing biodiversity: mitigation techniques and habitat enhancement	290
5.4.5	Building for biodiversity: constructing a more ecologically sustainable built form	291
5.4.6	Conclusions	296
5.5	Linking Social and Ecological Systems	298
	<i>Wayne C. Zipperer, Wayde C. Morse, and Cassandra Johnson Gaither</i>	
5.5.1	Introduction	298
5.5.2	Socio-ecological integrators	298
5.5.3	Modelling social-ecological systems	302
5.5.4	Summary	308
5.6	Building Urban Biodiversity through Financial Incentives, Regulation, and Targets	309
	<i>John Box</i>	
5.6.1	Introduction	309
5.6.2	Economic drivers to increase urban biodiversity	310
5.6.3	Legislation, regulation, and targets to increase biodiversity	312
5.6.4	Conclusions	315

