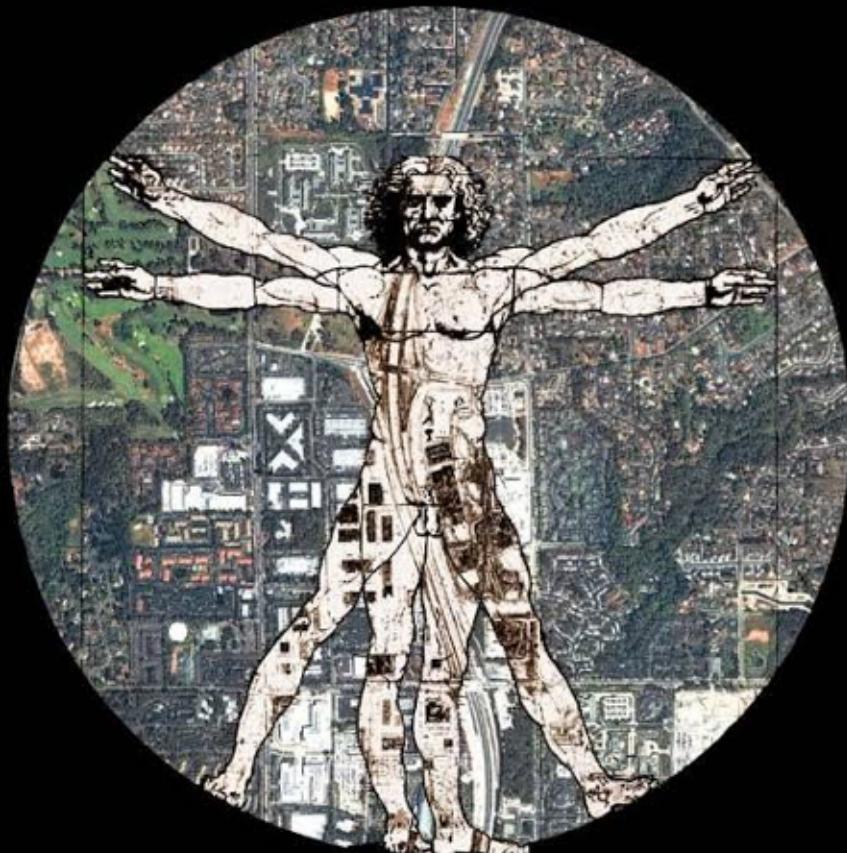


Marina Alberti

Advances in Urban Ecology

Integrating Humans and Ecological
Processes in Urban Ecosystems

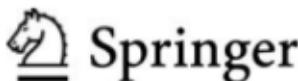


ADVANCES IN URBAN
ECOLOGY

Integrating Humans and
Ecological Processes in Urban
Ecosystems

by

Marina Alberti
University of Washington
Seattle, Washington, USA



Marina Alberti
University of Washington
Seattle, Washington, USA

Cover Design: Eric Knapstein

**ADVANCES IN URBAN ECOLOGY:
Integrating Humans and Ecological Processes in Urban Ecosystems**

Library of Congress Control Number: 2007936241

ISBN-13: 978-0-387-75509-0

e-ISBN-13: 978-0-387-75510-6

Printed on acid-free paper.

© 2008 Springer Science+Business Media, LLC

All rights reserved. This work may not be translated or copied in whole or in part without the written permission of the publisher (Springer Science+Business Media, LLC, 233 Spring Street, New York, NY 10013, USA), except for brief excerpts in connection with reviews or scholarly analysis. Use in connection with any form of information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed is forbidden.

The use in this publication of trade names, trademarks, service marks, and similar terms, even if they are not identified as such, is not to be taken as an expression of opinion as to whether or not they are subject to proprietary rights.

9 8 7 6 5 4 3 2 1

springer.com

*To Antonio, Leda
and Matteo*

CONTENTS

PREFACE.....	xi
ACKNOWLEDGMENTS.....	xvii
Chapter 1 THE URBAN ECOSYSTEM.....	1
1.1 The Dynamics of Urban (Eco)Systems.....	8
1.2 Cities as Human Systems	15
1.3 Cities as Ecological Systems.....	16
1.4 Cities as Hybrid Ecosystems.....	17
1.5 Complexity, Emergent Properties, and Self-Organization.....	20
1.6 Resilience in Urban Ecosystems.....	22
1.7 Rationale for a Synthesis.....	25
Chapter 2 HUMANS AS A COMPONENT OF ECOSYSTEMS.....	27
2.1 Emergence and Evolution of Settlement Patterns.....	29
2.2 Modeling Urban Development and Ecology.....	34
2.3 An Agent-Based Hierarchical Model.....	43
2.4 Modeling Changes in Land Use and Land Cover.....	49
2.5 Changes in Land Use and Land Cover in Puget Sound	54
Chapter 3 URBAN PATTERNS AND ECOSYSTEM FUNCTION...61	
3.1 Patterns, Processes, and Functions in Urban Ecosystems.....	61
3.2 Net Primary Productivity.....	78
3.3 Hydrological Function.....	79
3.4 Nutrient Cycles.....	81
3.5 Biodiversity.....	82
3.6 Disturbance Regimes.....	85
3.7 An Empirical Study in Puget Sound.....	86
Chapter 4 LANDSCAPE SIGNATURES.....	93
4.1 Hybrid Urban Landscapes.....	93
4.2 Gradients, Patches, Networks, and Hierarchies.....	95
4.3 Urban Landscape Signatures.....	103
4.4 Measuring Urban Landscape Patterns.....	112

4.5 Detecting Landscape Patterns in Puget Sound.....	117
4.6 Monitoring Landscape Change in Puget Sound.....	126
Chapter 5 HYDROLOGICAL PROCESSES.....	133
5.1 The Urban Hydrological Cycle.....	133
5.2 Urban Hydrological Functions.....	137
5.3 Human-Induced Changes in Urban Watersheds.....	144
5.4 Urban Patterns and Stream Biotic Integrity.....	152
Chapter 6 BIOGEOCHEMICAL PROCESSES.....	163
6.1 Urban Biogeochemistry.....	163
6.2 The Carbon Cycle.....	167
6.3 The Sulfur Cycle.....	170
6.4 The Phosphorus Cycle.....	172
6.5 The Nitrogen Cycle.....	174
6.6 Urban Patterns and Nutrient Cycling.....	176
Chapter 7 ATMOSPHERIC PROCESSES.....	183
7.1 Tropospheric Ozone.....	183
7.2 Urban Air Quality and Climate Change.....	186
7.3 Urban Heat Islands.....	187
7.4 Urban Patterns and Air Quality.....	194
Chapter 8 POPULATION AND COMMUNITY DYNAMICS.....	197
8.1 Biodiversity, Ecosystem Function, and Resilience.....	197
8.2 Urban Patch Dynamics.....	207
8.3 Urban Ecosystem Processes and Biodiversity.....	210
8.4 The Intermediate Hypothesis: A Case Study in Puget Sound.....	217
Chapter 9 FUTURES OF URBAN ECOSYSTEMS.....	225
9.1 The Challenges: Complexity, Heterogeneity, and Surprise....	225
9.2 Complexity and Predictability.....	227
9.3 Spatial and Temporal Heterogeneity.....	231
9.4 Threshold, Discontinuity, and Surprises.....	232
9.5 Scenario Planning and Adaptive Management.....	237
9.6 Hypothetical Scenarios of Urban Ecosystem Functions.....	242
Chapter 10 URBAN ECOLOGY: A SYNTHESIS.....	251
10.1 A Hybrid Ecology.....	251
10.2 Toward a Theory of Urban Ecology.....	254
10.3 Building Integrated Models.....	261

10.4 A Research Agenda for Urban Ecology.....	263
10.5 Implications for Urban Planning.....	267
10.6 A Final Note.....	270
GLOSSARY.....	273
REFERENCES.....	277
INDEX.....	355

Para tener acceso completo a este libro usted debe solicitarlo de manerla formal a la Coordinación del Programa de Doctorado Interinstitucional en Ciencias Ambientales mediante el **Formato de Préstamo Bibliográfico** ([descargar formato](#)) y remitirlo al siguiente correo: **dicambientales@unicauca.edu.co**



**DOCTORADO INTERINSTITUCIONAL EN
CIENCIAS AMBIENTALES**



Universidad
del Cauca