



Urban Ecology

An International Perspective on the
Interaction Between Humans and Nature

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John M. Marzluff

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Wilfried Endlicher

Marina Alberti

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John M. Marzluff · Eric Shulenberger

University of Washington, Seattle, WA USA

Wilfried Endlicher

Humboldt University, Berlin Germany

Marina Alberti · Gordon Bradley · Clare Ryan

Craig ZumBrunnen

University of Washington, Seattle, WA USA

Ute Simon

Humboldt University, Berlin, Germany

Editors

John M. Marzluff
University of Washington
Box 352100
Seattle, WA 98195

Wilfried Endlicher
Geographisches Institute
Humboldt University
Unter den Linden
10099 Berlin, Germany

Gordon Bradley
University of Washington
Box 352100
Seattle, WA 98195

Ute Simon
Humboldt University
Miningstrasse 46
12359 Berlin, Germany

Eric Shulenberger
University of Washington
3912 NE 127th Street
Seattle, WA 98125

Marina Alberti
University of Washington
Box 355740
Seattle, WA 98195

Clare Ryan
University of Washington
Box 352100
Seattle, WA 98195

Craig ZumBrunnen
University of Washington
Box 353550
Seattle, WA 98195

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For Herbert Sukopp, Urban Ecology pioneer

and

Marsha Landolt (Dean of the University of Washington's Graduate School), Debra Nickel (first program administrator of the University of Washington's Urban Ecology Program), and Bob Reineke (pioneer post-doc in the University of Washington's Urban Ecology Program) who gave so much to our interdisciplinary graduate program in Urban Ecology, but died too young

An introduction to Urban Ecology as an interaction between humans and nature

Urban Ecology is the study of ecosystems that include humans living in cities and urbanizing landscapes. It is an emerging, interdisciplinary field that aims to understand how human and ecological processes can coexist in human-dominated systems and help societies with their efforts to become more sustainable. It has deep roots in many disciplines including sociology, geography, urban planning, landscape architecture, engineering, economics, anthropology, climatology, public health, and ecology. Because of its interdisciplinary nature and unique focus on humans and natural systems, the term “urban ecology” has been used variously to describe the study of humans in cities, of nature in cities, and of the coupled relationships between humans and nature. Each of these research areas is contributing to our understanding of urban ecosystems and each must be understood to fully grasp the science of Urban Ecology. Therefore, in *Urban Ecology: an international perspective on the interaction between humans and nature*, we introduce students and practitioners of urban ecology to its roots, bases, and prospects by way of a diverse collection of historical and modern foundational readings. We editors are urban ecologists from the United States, Italy, and Germany who together view these readings as a fair representation of the importance of both natural and social sciences to Urban Ecology.

In this book we collect important papers in the field of Urban Ecology that both set the foundations for the discipline and illustrate modern approaches, from a variety of perspectives and regions of the world. We do this by reprinting important publications, filling gaps in the published literature with a few targeted original works, and translating several key works originally published in German. Our hope is that this collection of thoughts will provide students, practitioners, and professionals with a rich background in some of the core facets of Urban Ecology.

As you study these readings, it may be useful to consider the city as a set of strongly interacting systems or *spheres*. The urban ecosystem includes abiotic spheres (the *atmosphere*, *hydrosphere*, *lithosphere*, and soil or *pedosphere*) and biotic spheres (often viewed as an interacting *biosphere* of urban plants and animals plus the socio-economic world of people, the *anthroposphere*; Fig. 1). The readings deal with each of these spheres, and also with the connections between and amongst them. These connections have been and continue to be viewed very differently by the authors of the articles in this collection. The relative importance of the spheres changes with one’s research bias, but more importantly the way and extent that authors have represented the connections among the spheres (or even the degree of isolation of the spheres) differs vastly. Look for these differences as you read the collection. Our view is that the interrelated processes among the subsystems (spheres) must be studied and understood to understand the ecology of a city. This is what modern Urban Ecology strives to do.

We organize the readings in six related sections. Together they cover studies of the natural and anthropogenic aspects of urban ecosystems. As one moves forward in time, they increasingly focus on inter-relations of people and nature where they co-occur in urban places.

In Section I: *Urbanization and Human Domination of Earth*, four papers show why Urban Ecology is an important and growing discipline. They detail the trends of increasing human domination of Earth generally, and of urbanization, specifically. They review the extent of urbanization and its

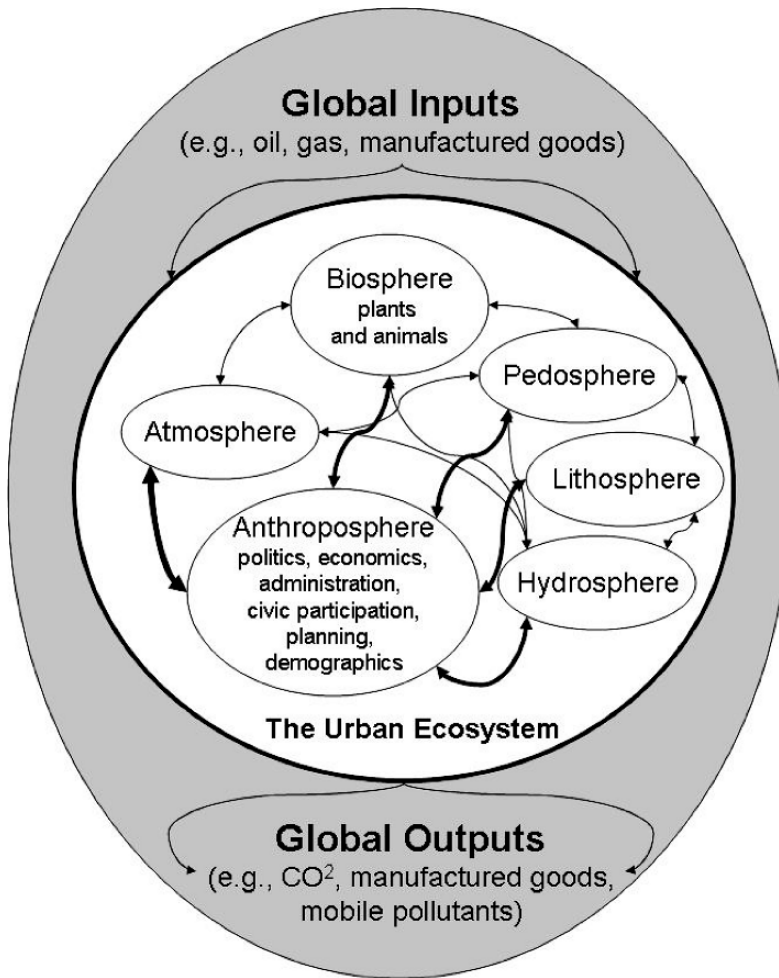


Fig. 1 Basic components of the urban ecosystem; some examples (arrows, width denotes relative magnitude) of relationships among them; and its global footprint (shaded area). The urban ecosystem, like other human-dominated systems, is characterized by the large direct and indirect effects of the anthroposphere upon other biotic and abiotic systems and upon those systems' interactions

relation to other human endeavors that have changed the face of Earth. Together the papers examine the impacts of humans on basic ecological and evolutionary processes.

In Section II: *Conceptual Foundations of Urban Ecology*, five recent review articles report on the interdisciplinary synthesis that is modern Urban Ecology. Cities are viewed quite differently by early social ecologists like Burgess, by European pioneers like Sukopp, and by more recent emerging interdisciplinary American urban ecology teams. Again, as we move forward in time, cities are increasingly viewed as emergent phenomena with a new level of organization whose macroscopic properties and behavior are poorly predictable from knowledge of the properties of their constituent parts. This strongly suggests that cities are, in fact, an entirely new type of ecological entity - an entirely new level of complexity and organization - and that they must be studied as integrated systems. Precisely how these emergent phenomena have been studied has differed somewhat along disciplinary and geographic boundaries. Two major approaches in modern studies can be called "ecology *in* cities" and "ecology *of* cities" (Fig. 2). In Europe, we see a strong tendency to study the ecology of individual species or other taxa (but seldom *Homo sapiens*) within a city. The early

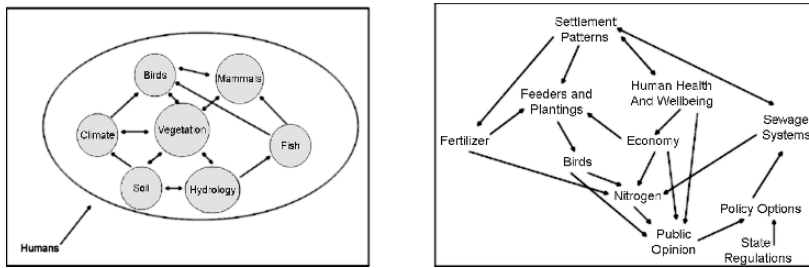


Fig. 2 An example of relationships in a typical study of ecology *in* the city (left) and ecology *of* the city (right)

American view championed by Burgess and others in Chicago focused on social processes and used ecological concepts to understand socio-economic dynamics in cities. On the other hand, early European urban ecology had been dominated by geographically constrained, traditional, autecological studies. It is only recently that urban ecology in both the USA and in Europe has expanded to include more complex interactions between human and natural systems across many scales.

In Section III: *The Atmosphere, Hydrosphere, and Pedosphere*, we present seven readings on the physical underpinnings of urban ecosystems. They cover the influence of urbanization on soils, hydrology, and climate, illustrate the effects of these changes on global climate and pollution, and consider various effects on human health.

Section IV: *The Biosphere* provides fourteen readings on specific environmental and ecological aspects of urban ecosystems. The studies cover ecological patterns, processes, and impacts, and link human effects on the abiotic environment to their effects on aquatic and terrestrial ecosystems. Research on birds in urban environments is highlighted because studies on the effects of urbanization on birds have a long and rich history in many parts of the world. We synthesize similarities and differences in how various animals and environments respond to urbanization while pointing out the importance of vegetative structure and composition (and therefore of soil formation and nutrient cycling) in helping to determine the structure of urban animal communities. The selections show how most studies *in* urban ecosystems focus on individuals, populations, or communities of plants and animals, while studies *of* urban ecosystems typically focus on ecosystem-level processes like nutrient cycling and energy flow.

Section V: *The Anthroposphere—Human Dimensions* explores the socio-economic aspects of urban ecosystems and links human settlement to ecosystem function, human health and well-being, and social justice through nine papers. Some important social science approaches are illustrated as the included authors investigate human decision-making and patterns of human settlement. Some articles explicitly consider sustainability of urban development at local and global scales. Our selections have been guided by our intent to synthesize social and economic drivers of various settlement patterns and to appraise the economic, ecological, and social sustainability of urban systems.

Section VI: *The Anthroposphere—Planning and Policy* presents eleven papers that together review the practical application of urban ecological knowledge to urban planning, conservation in and of urban ecosystems, and policy formulation. The suite of papers introduces the complexities of human urban institutions and the difficulties of managing them for local environmental health. They also present basic planning strategies intended to conserve or promote biological diversity in urbanizing areas. To help in making decisions at the policy and planning levels, these papers also discuss modeling strategies for appraising change in ecosystem function resulting from such decisions. Our synthesis builds on the readings to suggest general principles that would help increase the inclusion and use of urban ecological knowledge in the social arenas of planning and policy making

As we study the foundations of Urban Ecology, rarely do we see the various scholars in our field stand back and attempt to place cities into a larger ecological context. That larger-scale vision is now rapidly developing, and is the direction in which Urban Ecology, as a field, is clearly headed.

Cities are both drivers of, and driven by, ecological processes within and beyond their boundaries. It is no longer acceptable – indeed, it is highly counterproductive - to separate human and natural components in urban ecological studies. Cities are complex human phenomena, but they must be understood in new contexts:

First – cities should be studied both as social and biophysical phenomena. Like other complex phenomena, cities have generalizable and definable internal structures, functions, and processes that produce cities’ emergent properties. Many of those internalities are not yet identified, much less understood.

Second – cities have incredibly large impacts on Earth’s ecological processes, at all spatial scales yet studied, and with temporal scales yet to be determined. Cities have huge ecological “footprints” caused by their needs for goods, energy and services and their capacity to import natural resources from, while exporting their emissions and wastes to, distant regions. For these same reasons cities also have the potential to offer unique opportunities for resource conservation and environmental impact mitigation.

Our collection of writings suggests that there are at least three views of Urban Ecology as a field: (1) ecology and evolution of organisms that happen to live within city boundaries; (2) biological, political, economic, and cultural ecology of *Homo sapiens* in urban settings; (3) cities as emergent phenomena of coupled human and natural processes with implications for evolution and survival of our own and other species.

We believe that the third view – to which we ourselves subscribe – is the direction that the field can and must go. This view allows various aspects of the human enterprise and nature to be seen as interacting forces that shape measurable patterns and processes. Human factors are not isolated from other biotic or abiotic factors - together, as coupled human-natural systems, they both drive and are affected by the patterns and processes they create (Fig. 3). Ultimately our ability to build more resilient cities depends on a better understanding of the mechanisms that govern these interactions.

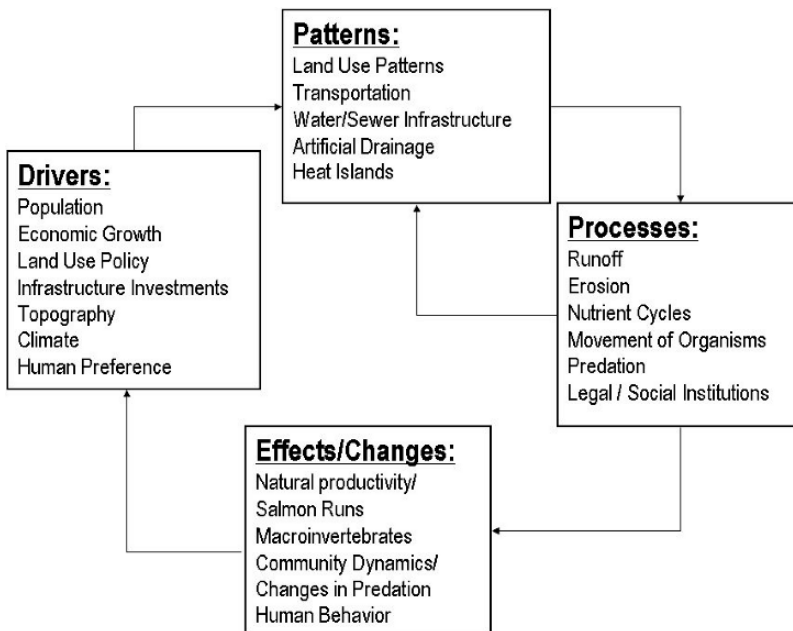


Fig. 3 A view of Urban Ecology that emphasizes the coupled relationships between humans and nature. Abiotic and biotic (anthropogenic and otherwise) drivers cause patterns and processes that urban ecologists measure. But these patterns and processes themselves affect interacting human and natural drivers by their effects and changes to the urban ecosystem

This is a productive time for the field of Urban Ecology. Groundwork by the many scholars represented in this reader has set the foundations for the development of new hypotheses about the similarities and differences of urban ecosystems and non-human-dominated ecosystems. There are many challenges and exciting discoveries to be made along this journey. Travelers will bring with them varied backgrounds, including theoretical and applied interests in the natural and social sciences. The field will advance as new theories are conceived, data are collected, simulation models are developed, and knowledge is used to inform planning and policy-making. We encourage theoreticians to fully conceptualize and model the complex web of interactions between humans and our ecosystem. Empiricists can test theory and document the dual nature of feedbacks amongst human health, economies, and cultures and the biotic and abiotic components of their ecosystems. Understanding coevolved relationships that often emerge from long-standing interactions between people and nature will be a special challenge that must be accomplished if a full understanding of the evolutionary aspects of urban ecology is to develop. Linking this basic knowledge to informed practice is perhaps the greatest challenge for Urban Ecology. Doing that will require a full integration of the natural and social sciences, careful distillation and application of complex ecological knowledge, and dedicated practitioners. These practitioners include planners, engineers, architects, landscape architects, and policy makers. Their actions quite literally shape our urban ecosystems. However these practitioners are also shaped by the responses of the ecosystem. We feel strongly that those who find this field interesting and who choose to participate in it through research or practice will benefit from understanding where the field has been and how it got to where it is today. Only then can we intelligently participate in moving the field forward. Providing that knowledge, and illustrating the theory, implications, and application of Urban Ecology is the purpose of this book.

John M. Marzluff, Eric Shulenberger,
Wilfried Endlicher, Ute Simon,
Craig ZumBrunnen, Marina Alberti,
Gordon Bradley, and Clare Ryan
University of Washington, Seattle, WA USA
and Humboldt University, Berlin

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