

APPLIED URBAN ECOLOGY

The background of the book cover is a photograph of a park-like setting. In the foreground, there are tall, golden-brown reeds or grasses. In the middle ground, two people are walking away from the camera on a path that leads towards a body of water. To the right, there is a modern wooden walkway or bridge structure over the water. In the background, a city skyline is visible through a hazy atmosphere, with several tall buildings, including a prominent one with a curved facade.

A Global Framework

Edited by
Matthias Richter and Ulrike Weiland



WILEY-BLACKWELL

APPLIED URBAN ECOLOGY

APPLIED URBAN ECOLOGY: A GLOBAL FRAMEWORK

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 **WILEY-BLACKWELL**

A John Wiley & Sons, Ltd., Publication

This edition first published 2012 © 2012 by Blackwell Publishing Ltd.

Blackwell Publishing was acquired by John Wiley & Sons in February 2007. Blackwell's publishing program has been merged with Wiley's global Scientific, Technical and Medical business to form Wiley-Blackwell.

Registered office: John Wiley & Sons, Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

Editorial offices: 9600 Garsington Road, Oxford, OX4 2DQ, UK

The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

111 River Street, Hoboken, NJ 07030-5774, USA

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Library of Congress Cataloging-in-Publication Data

Applied urban ecology : a global framework / edited by Matthias Richter and Ulrike Weiland.

p. cm.

Includes bibliographical references and index.

ISBN 978-1-4443-3339-8 (hardcover : alk. paper) — ISBN 978-1-4443-3340-4 (pbk. : alk. paper) 1. Urban ecology (Biology)
2. Applied ecology. I. Richter, Matthias, 1964- II. Weiland, Ulrike.

QH541.5.C6A67 2011

577.5'6 — dc23

2011019097

A catalogue record for this book is available from the British Library.

This book is published in the following electronic formats: ePDF [9781444344998]; Wiley Online Library [9781444345025]; ePub [9781444345001]; Mobi [9781444345018]

Set in 9/11pt Photina by Laserwords Private Limited, Chennai, India

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Foreword

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The majority of people worldwide live in cities and their number continues to increase. It seems that our common future has an urban perspective. Worldwide, cities offer an attractive living environment for the majority of people. This growth process of the cities was observed and described decades ago, but only in the last few decades has the drama of this development been recognized. Not only do highly effective socioeconomic urban systems arise, which compete with one another, but also new living areas for people, whose current and future main living space is the city.

In the old cities, which can already look back upon several centuries of development, sometimes hard-won experiences already exist for the continuing improvement of this living area for people and to technically modify that which exists to the changing demands of humans and the economy. Shrinkage, multiethnicity and the development of the city into the surrounding countryside – the last being a process which endangers nature and is energetically questionable – provide new challenges.

In the dynamically growing cities, in particular in Asia and parts of Africa and Latin America these experiences first have to be made. Here, it is often difficult to obtain an overview of the growth processes, let alone to be able to control these optimally or even at all. Thus cities arise, which not only grow more quickly than their economic base would necessitate, but also environmental conditions arise that are unhealthy and risky for the people living in and moving to the cities. This does not only apply to the mega-cities, but also to the many “small” cities with a population of much less than 1 million. Unprepared city administrations are confronted with what are often unsolvable problems. A few targeted measures of environmental hygiene, traffic

development or the control of residential development could already hugely improve the situation.

The global perspective on the development of the cities is thus heterogeneous and is dependant on growth dynamics, socioeconomic conditions, cultural relationships, and last but not least on the ecological framework conditions of the regions. Cities cannot be meaningfully compared to one another, but their problematic situations can be. These require structuring interventions and controls, often very quickly, in order to avoid deep-rooted, long-lasting and encumbering effects on people's health, the environmental conditions and the reduction in efficiency of the future urban development.

It is no longer possible to support this through one or a few research fields. The problem conditions are too complex, the connections between sociocultural, economic and environmental systems too strong. Technical solutions alone are no longer sufficient and their arbitrary transfer to culturally and economically different urban systems has often even caused further problems, which had not been thought of before. The singular optimization of urban development aspects is almost ruled out in favor of a multi-criteria approach.

Since the 1970s this point of view has gained more and more notice from academics of various disciplines in Central Europe. There is and was one common element: to provide a contribution to the improvement in management through the academic research of the complex urban systems or their parts. It was, and is, obvious that the ecosystem city (created, used and more or less controlled by people) has to be the object of research and design. This open and highly complex ecosystem city became the object of specialists, but

even more so of concerted and cooperative research from many different specialist perspectives. Here the traditional, limited outlook first had to be overcome, which did not want to interpret the city in terms of ecological systems.

Although it was first biologists, climatologists and urban planners who occupied themselves with the urban ecosystems, hydrologists, pedologists, geographers, economists, political scientists, and planners from various fields quickly came as well, and many others too. A cross-sectional discipline – urban ecology – was formed. This development process of the discipline of urban ecology, which has already existed for 40 years, has, however, not yet been finalized. The theoretical–methodical basis is naturally heterogeneous and strongly determined by the participating disciplines and their approaches. What urban ecology is or can be depends less on the relationship to a fixed theory and methodical structure, but more on the perspective of the participating academics and disciplines. The terminus ecology itself, from an urban context, has developed from relating to the life–environment–relations in the biosciences, for example, into the normative aspects of planning and politics. There is no ordering institutionalization here. It is, at least at first, also not completely necessary.

Landscape ecology is also a complex cross-sectional discipline integrated into urban ecology early on, first as an exotic section. Now with research topics, research institutions and user requirements worldwide urban ecology has proved itself to be an important part of landscape ecology. In 2009 it established itself for the first time independently and self confidently in a worldwide Society of Urban Ecology (SURE).

Our knowledge of the urban ecosystems, their spatial–functional process pattern and their interaction are still incomplete and limited and thus urgently need to be extended. On the other hand the requirements of the design process aimed at the urban ecological viewpoint are so pressing and in need of being served, that these cannot remain unfulfilled with reference to the not yet complete knowledge about the urban ecosystems. For this reason urban ecologists must work in a particularly applied manner. Their field of operation lies here, it is here that they can gain increasing acceptance and help to solve manifold problems of the cities.

The merit of this book is to provide a contribution for this from a global viewpoint. The variety of approaches to urban ecology and its challenges are consciously made the focus here. The approaches of the participating disciplines will be portrayed, although this is only possible in exemplary form, and the wide field of uses will be dealt with to a notable extent. Here it is mainly the huge challenges such as the retention or production of healthy living conditions in cities, dynamic changes of use, adaptation to climate change and the preservation of biodiversity, which are dealt with as focal points. The synthesis, to continue to further develop a multicriteria, methodical and manifold urban environmental management, without ignoring the extension of the academic-theoretical basis of urban ecology, is obvious.

With this book Ulrike Weiland and Matthias Richter have produced an excellent and suitable text book of applied urban ecology, which takes on the current challenges in a global perspective and uses examples to demonstrate approaches and solutions.

PART I

INTRODUCTION

CHAPTER 1

Urban ecology – brief history and present challenges

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1.1 INTRODUCTION

Urban ecology plays an important role in understanding urban systems. In order to analyze and apprehend, for instance, urban land use changes and their impact on the regional water balance, the role of urban green spaces for the local climate, conditions for the coexistence of species in an urban setting, or resource fluxes and opportunities to reduce and optimize them, it is necessary to know how urban systems function and how and to what extent they both impact and are affected by global or regional processes. Urban ecology is characterized by a variety of approaches. It is an interdisciplinary research field at the interface of natural sciences, social sciences and humanities as well as engineering. As an interdisciplinary research field urban ecology investigates the interrelations between environmental compartments and human activities such as construction, production, housing, and transport. As an applied scientifically based approach, urban ecology gives hints about where and how the urban environment may be protected from further harm, and how environmental quality and thus physical human living conditions may be improved.

Today's urban ecology differs widely from its beginnings. Its traditional lines have a close connection to the scientific and social context of their time as well as to the respective urban structures. Five traditional strands of urban ecology can be differentiated by

analyzing their preferred research aims, their scientific approach, and their research motives; they occur partly in parallel but at the same time. Knowledge of the history of urban ecology is helpful in order to understand the recent approaches presented in this book; therefore general lines of tradition of urban ecology will be discussed first in the following prior to depicting present challenges (Richter and Weiland 2008, Weiland and Richter 2009).

1.2 BRIEF HISTORY

1.2.1 Initials in urban natural history

The beginning of urban ecological research is rooted in 16th century observations of nature in cities when spontaneously growing species in the cities drew the attention of botanists to stone walls, castles, and ruins, which were identified as the first "habitats" (Sukopp 1994, 2002). Since the notion of "urban ecology" did not yet exist at that time, this approach has been called the "line of tradition rooted in natural history" (Weiland and Richter 2009, p.50). At that time the European city was characterized by a very high building density within the city walls. Extensions of the built-up area set up the preconditions for further urban development (Mumford 1963, Lichtenberger 2002). Knowledge of the medical use of herbs was widespread. Thus, it is not surprising that interest in acquiring knowledge about nature was applied to cities at these

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early times. Today, this traditional line continues as a partial aspect of bioecological (e.g., Penev *et al.* 2005) and biogeographical research approaches (e.g., Wania *et al.* 2006).

1.2.2 Socioecological tradition

During the industrialization phase, the sociology branch of the Chicago School had a major influence on the development of urban ecology. In the 1920s Chicago was in the heyday of industrialization, and was a typical example of the rapidly growing, unsanitary industrial cities of the 19th and early 20th centuries in North America and Europe, with extremely high-density tenements, deficits in water supply, sewage and waste disposal, poor air quality, and poor lighting conditions. These conditions and their consequences provoked Robert E. Park to commence his socioecological studies, which were strongly influenced by Georg Simmel and Max Weber, amongst others (Park *et al.* 1925). The Chicago School investigated the interrelations between city and society, in particular the living conditions of the industrial workers. Robert E. Park and Ernest W. Burgess tried to explain the urban development processes of Chicago and their impacts on social groups by means of a human–ecological or “quasi biological” research approach (Feagin 1998, p.2) using theoretical concepts of animal and plant ecology: e.g., succession, symbiosis, competition, and adaptation (Kurtz 1984, p.21). They explained phenomena such as migration and segregation phases of different population classes and social minorities with the help of “invasion-succession cycles” and city structure models. This approach has been profoundly criticized because of its biological basis. Later on, the socioecological tradition of urban ecology was superseded by a collateral human ecological perspective (e.g., Winter and Mack 1988, Fellenberg 1991).

1.2.3 Complex bioecological tradition

The perception of the finite nature and instability of the supply of fossil resources increased after the climax of the economic boom in the United States and Europe that followed the Second World War. As a consequence, urban ecology received much more attention than before. In the 1970s Herbert Sukopp and a group of colleagues developed a complex bioecological approach

to urban ecology (e.g., Sukopp 1973, 2005). In its early years, the Berlin School of Urban Ecology carried out mainly ecological site analyses and field botany research on wasteland that existed in great quantities in Berlin in the years after the Second World War. Its approach, which maintains urban flora, fauna, and habitats as its core, can be considered a more versatile strand of the line of tradition rooted in natural history. In this approach humans influence and superimpose natural habitat conditions, especially in the form of land use and land use changes. Research is centered on organisms, species, and their habitats; additionally urban climate, soil, and water bodies are investigated, mainly as habitat conditions for urban flora and fauna. Humans play a role as a source of disturbance and as users of urban nature, above all for recreational purposes. A further central and application-oriented motive for research is to transfer nature conservation to cities and urban areas in order to protect urban nature for the human inhabitants. Further research approaches that can be considered to be examples of this line of thought are presented, for example, by Wittig (1991) and Gilbert (1989).

1.2.4 Ecosystem-related tradition

During the same time period as the Berlin School of Urban Ecology, an (eco-)system related tradition of urban ecology evolved on an international level. This approach is highly influenced by American and German landscape ecology (Tansley 1935, Troll 1939, 1968, Schmithüsen 1942, Neef 1967) and systems theory (von Bertalanffy 1953), the systemic approach linking both research directions; later influences can be characterized by the keywords “patterns and processes.” Major international research programs such as UNESCO’s Man and the Biosphere Program (MAB) (Spooner 1986) and the International Biological Program (IBP) initiated large research projects in this area. The ecosystem-related tradition is heterogeneous; two main directions can be distinguished.

The first direction: ecological analyses of urban landscapes

Landscape ecological studies were assigned to cities and city sectors with the aim of identifying ecological patterns and processes. Within this theoretical framework, a long history of approaches focuses on the analysis of

urban–rural gradients (McDonnell and Pickett 1990, Kinzig and Grove 2001). Studies of metapopulation theory, which also have been carried out in cities since the 1990s, often show overlaps between organism approaches and landscape ecology approaches (Niemelä *et al.* 2002). Further research projects focus on the interrelations between urban structures and compartments of the urban natural environment (e.g., Breuste *et al.* 1998).

The second direction: analyses of urban material and energy flows

The *Fundamentals of Ecology* (Odum 1953), serving as the scientific basis of this research approach, explains physical and chemical processes of aquatic, terrestrial, and anthropogenic ecosystems using a systems approach. Research is not focused on organisms, but on substances and material flows. From the 1970s onward, energy flows were also included, induced by the oil crisis that promoted awareness of the impermanent character of natural resources. Independently from each other, the ecologist Howard T. Odum (1953) and the urbanist Lewis Mumford (1963) influenced architects as well as urban and regional planners in the subsequent ecological movements – triggered by the Club of Rome’s publication *Limits to Growth* (Meadows *et al.* 1972) – to take into consideration both the cultural–historical and the ecosystems approach in their plans and concepts. Material and energy flow studies of, for example, Brussels (Duvigneaud 1974) and Hong Kong (Boyden *et al.* 1981) were conducted (see also Baccini 1996). Since then, cities have been considered “importers” and “intermediate stores” (Baccini and Bader 1996) of large masses and of a variety of resources (Chambers *et al.* 2001). Quantitatively the most important fluxes are those of energy, water, food, and building materials. Since recycling processes barely exist, warmth, waste water, garbage, and waste air are deposited, pass through the urban environmental systems and cause local, regional, and sometimes global environmental problems (Dávila and Atkinson 1999). The most important merits of this approach include its contribution to an increased understanding of how (and which) substances accumulate in different ecosystem compartments (e.g., urban soil, ground floor vegetation, trees) and how they can become dangerous for plants, animals, and humans via food webs. Furthermore, the identification and quantification of regional to global material and energy fluxes has increased

the understanding of global interconnectedness of the single city, not only in economic aspects, but also with respect to resource flows and environmental pollution.

Long-term ecological research (LTER) sites

A considerable step forward in international recognition of urban ecology can be attributed to the interdisciplinary research teams at the Long-Term Ecological Research (LTER) sites in Baltimore and Phoenix in the United States and to cooperating research groups (Alberti 2008, Grimm *et al.* 2008, Marzluff *et al.* 2008). The research on urban LTER sites also can be traced back to the ecosystem-related tradition and at the same time it deepens the urban ecological knowledge and enriches it by using up-to-date techniques.

The urban ecology research program in Baltimore, Maryland, seeks to understand an urban region as an ecological system and investigates

- 1 the relations between spatial structures of socioeconomic, ecological, and physical features and their changes over time,
- 2 the fluxes of energy and matter as well as human influences on these, and
- 3 options to improve the quality of the urban environment.

The urban ecological research program in Phoenix, Arizona investigates the structures and functions of an urban ecosystem in an arid environment – the Sonoran Desert – and aims at understanding the distribution and perception of ecosystem services in the metropolitan region of Phoenix (see Chapter 4). Urban ecology, according to this research approach, considers urban agglomerations as complex systems with integrated social, economic, ecological and technical subsystems. It analyses, for example, socioecological drivers of land management and ecosystem responses, nitrogen fluxes as well as social vulnerability, environmental inequity and health (ASU 2011).

1.3 RECENT AND PRESENT CHALLENGES

Several main steps forward in urban ecology can be observed in recent times: on the one hand, urban ecological research is increasingly carried out in international settings, parallel to economic globalization, while most research activities are still based in North America and Europe (Deeter 2003). On the other hand, a tendency of convergence of research themes and methods

can be observed, although the orientation of urban ecological research towards ecosystem research is stronger in North America than in Europe (Zipperer *et al.* 2000).

Furthermore a complex systems approach to cities and their ecology has become common within the majority of the scientific community. Today, cities are considered to be coupled complex human and ecological systems. They are characterized by non-linear development over time with unforeseen changes and leaps forward, and new emerging properties. Multiple agents, feedback mechanisms and their variability in time and space imply complexity, heterogeneity, and surprise as inherent characteristics of urban ecosystems. As a consequence, their behavior is not exactly predictable and prognoses are uncertain (Alberti 2008, p.225 ff.). Urban risks as well as vulnerability and resilience of urban systems represent recent research issues. These advancements in urban ecological research correspond with the growing challenges to urban ecology posed by the larger urban impacts on the environment.

Today, urbanization, i.e., the change of lifestyles, and urban growth, metropolization and mega-urbanization are dominant urban development processes in most parts of the world. Since 2008, the majority of the world population is urban¹, and in 2050, this share is expected to be 70%. The 21st century is addressed as the “urban century” (UNESA 2008).

Urban areas are subject to large-scale influencing factors such as economic, sociodemographic, technological, and environmental change, referred to as global, demographic and climate change. They imply chances and risks for the cities and urban agglomerations.

In regard to this, urban development processes are characterized by a large variability; dynamically growing agglomerations contrast with economically weak and stagnating cities, whereby growth and shrinkage processes also occur at the same time within cities. In (former) industrialized cities large brownfield areas remain as relicts of the Industrial Age comprising socioenvironmental risks as well as opportunities for new beginnings.

From an environmental point of view, urban sprawl (urban expansion up to the “networking of cities”),

causes not only an increase of resource use, but also a fragmentation of landscapes and the loss of natural areas. Economic activities and transport lead to environmental pollution far beyond the physical and administrative urban borders (Hall and Pfeiffer 2000). Urban growth and urbanization are changing a growing number of natural or seminatural habitats and former agriculturally productive areas, for example, by producing heat islands, causing water pollution, and by contributing to desertification. Urban systems are “flow-through systems”; by far the largest part of energy and material fluxes of the human economy returns in an altered form as pollution and waste to the ecosphere. A number of scientists, prominent among them Saskia Sassen, consider that “this makes cities a source of most of the environmental damage, and some of the most intractable conditions feeding the damage” (Sassen 2009, p.46). However, it is not urbanization *per se* that necessarily causes negative impacts on the environment, but rather the particular types of urban systems and the way of industrial production as well as deficits in urban governance. Since cities are not only polluters, but also sites for innovation, it is “within the complexity of the city that we must find the solutions to much environmental damage and the formulas for reconfiguring the socioecological system that is urbanization. [...] Cities make the multi-scalar property of ecological systems present and recognizable” to decision makers and urban inhabitants. As a consequence, improving the urban environment and reducing the environmental impacts of urbanization on regional, national, and the global environment entails a multi-scalar approach (Sassen 2009, p.46).

Global urbanization and its unintended negative effects, not only on the urban environment and the urban dwellers, but also on the entire environment, necessitate sustainable urban development on various scales. Habitat Agenda and Agenda 21 contributed to establishing a common understanding that cities rebound to global and local environmental problems and are a potential arena in which to address sustainability. Many cities try to implement sustainable urban development (c.f. extensive database in IISD 2010); it is about – according to Agenda 21 (UNEP 1992) – integrating ecological, economic, social, and cultural aspects of urban development in a long-term perspective, including good human health conditions. Sustainable urban development requires the cooperation of a variety of authorities, stakeholders, and social groups on different political levels, including the heads

¹ The definition of “urban” differs between countries; here it depicts the percentage of the total population living in areas termed “urban” by the respective country. The definitions range from population centers of 100 or more dwellings to only the population living in national and provincial capitals.

of international organizations and consortia. It applies to the local level while considering regional, national and global interrelationships, because the ecological regulation of cities can no longer be separated from wider questions of regional, national, and global governance. Sustainable urban development is a goal of political negotiation with no foreseeable end point (Grunwald and Kopfmüller 2006, Atkinson *et al.* 2007, Girardet 2007).

Considering the differences between cities and the variety of urban development processes, it becomes obvious that the general meaning of sustainable development has to be transferred to the prevailing local conditions, and that every city has to find its own way of striving for sustainability. As a consequence, differing understandings of sustainable urban development exist; the complexity of the integrated model and its need for interpretation are both its characteristic and its problem. In Europe important objectives are, for example, mixed urban development and the “city of short distances” (*Stadt der kurzen Wege*) in order to avoid further urban sprawl (Baccini and Oswald 1998, Oswald and Baccini 2003). The large amount of public awareness that the sustainability discussion enjoyed in the 1990s has diminished to date due to changes in the relevance of issues on the political agenda. Nevertheless, sustainable urban development has never disappeared from the political agenda; international organizations work on its implementation, and the scientific discussion has never broken off (Girard *et al.* 2005, Elliott 2006, Atkinson *et al.* 2007, Girardet 2007).

Parallel to the sustainability discourse, but only partly linked to it, and only indirectly referring to urban ecology, the discourse on “new urbanity” has spread among architects and planners in North America and Europe since the 1980s (Häußermann and Siebel 1995, Swyngedow *et al.* 2002, Oswald 2003). “New urbanity” is understood as “the way of living of the majority of people in developed countries” that is “based on modern technical, social and organisational preconditions” (Oswald and Baccini 2003, p.291). It is an alternative draft to the decline of heavy industry, river- and seaports, to suburbanization and urban sprawl. The concept of “new urbanity” is multifaceted: urban reconstruction, revitalization of urban brownfields, rebuilding of historic townscapes, and the rediscovery of urban waterfronts characterize the concept. Some examples are the Docklands in London and Dublin, Kop van Zuid in Rotterdam, or Harbour City in Hamburg.

Both concepts “sustainable urban development” and “new urbanity,” have an influence on urban development that is difficult to measure and mostly concentrated in scattered projects. In the majority of cases “new urbanity” specifically addresses urban ecology only indirectly. Nevertheless, urban environmental research has been carried out and discussed more frequently under the aspects of resource protection and diminution of environmental pollution aiming at equal opportunities for future generations, which are considered constituent parts of the integrative concept of sustainable (urban) development (IWM EB 2002, Marchettini *et al.* 2004, Mander *et al.* 2006, Weiland 2006, Kennedy *et al.* 2007).

At the International Conference of Urban Ecology in 1997 in Leipzig, a broad scope of issues related to urban ecology, the perception of urban ecological issues by urban citizens, and policy approaches were discussed (Breuste *et al.* 1998). Furthermore, “redesigning the urban metabolism in view of sustainability goals” is considered a relevant research question for urban ecology (Brunner 2007). These examples show that urban ecological research has both thematically expanded compared to previous decades and has also shifted towards investigating the applicability of research findings in urban decision making (Baccini 1996, Alberti *et al.* 2003, Pickett *et al.* 2004, Müller *et al.* 2008).

1.4 PURPOSE AND STRUCTURE OF THE BOOK

1.4.1 Purpose of the book

This book *Applied Urban Ecology – A Global Framework* bridges the gap between theory and practice and presents a broad spectrum of urban ecology approaches from systems research to environmentally sound urban design, exemplified by selected case studies from different continents. This claim is met by engaging experts from geographically different parts of the world (in alphabetical order): from China, Germany, India, the Netherlands, New Zealand, South Africa, Sweden, Switzerland, United Kingdom, and the United States, and by including widely acknowledged scientists on a keynote speaker level accompanied by up-and-coming scientists. The conception of the book derives from a 5-year study “Urban Ecology – an International Comparison” and an investigation of the preferred up-to-date research questions at large research institutions.

Based on this study, the book portrays a range of recent approaches to urban ecology and focuses on providing knowledge and expertise for the application of urban ecological findings. *Applied Urban Ecology – A Global Framework* is a contribution to support the improvement of environmental quality in urban settings by mutually learning from other attempts.

The purpose of this book is to provide urban ecological knowledge in a nutshell tailored to supporting environmentally sound urban development and based on a sound theoretical and contextual framework, including case studies. It is conceived as a textbook targeted for an international readership, especially for advanced students and PhD students, researchers, and experienced practitioners in the fields of urban ecology and landscape ecology, urban environmental research, environmental geography, urban planning and landscape architecture, and sustainable urban development.

1.4.2 Structure of the book

The structure of the book reflects the variety of approaches to modern urban ecology.

Parts I–II

In Part I “Introduction”, Ulrike Weiland and Matthias Richter lead into the subject matter of the book by portraying urban ecological research approaches briefly within the context of their respective societal context, and by depicting recent and present challenges to urban ecology.

In Part II “Urban Ecology: Related Disciplines and Methods”, Matthias Richter and Ulrike Weiland give an overview of disciplines and methods related to urban ecology. Ellen Banzhaf and Maik Netzband discuss opportunities of monitoring urban land use changes with remote sensing techniques.

Part III

In Part III “Selected Fields of Applied Urban Ecology” case studies on various topics from different parts of the world are presented. It becomes obvious that in different countries different problems are on the agenda of urban ecologists. It is of the utmost importance to be aware of the ways in which urban ecological

topics are determined and constructed, as well as the respective goals of research. The following issues are addressed:

Pathways of the ecosystem approach

The ecosystem approach has been one of the most influencing research pathways in the field of urban ecology during the last 25 years. Pathways of the ecosystem approach are discussed from two different perspectives. Jianguo Wu and his co-authors report about the research experiences in long-term research areas that are in the framework of the LTER network in the United States: Baltimore, Maryland and Phoenix, Arizona. Another prominent pathway of the ecosystem approach is represented by the work of Peter Baccini. He shows how sustainable use of substances and energy in the urban area should be combined with urban planning, thus leading to a resource-sparing urban development. This approach uses the “Schweitzer Mit-telland” as a case study.

Socioenvironmental threats

The focus in this section is on changes in urban areas resulting in socioenvironmental consequences and it explores the question of how everyday life for humans is influenced. The chapters cover a wide range of urban environments in industrialized countries as well as developing countries and sheds light on different types of socioenvironmental and health threats. Surinder Aggarwal and Carsten Butsch show how the growth of Indian mega-cities has been and is being accompanied by severe environmental problems and health risks, especially related to air and water pollution and poor sanitary conditions. Dieter Rink and Harriet Herbst highlight abandoned green open spaces from different perspectives including socioecological aspects. The different meanings of urban wilderness for citizens are contextualized in their contribution.

Flooding and climate adaptation

In recent times global change has been a more intensively discussed topic in general and this also influences its relevance for urban ecology. Therefore, this up-to-date topic is included. Dinand Alkema and Norman Kerle report about their experiences with flood risk assessment in Southeast Asian cities, such as Naga, Philippines. They use different methods (e.g., GIS and scenario techniques) for warning urban citizens about