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Urban Biodiversity and Design

Edited by

Norbert Müller, Peter Werner & John G. Kelcey

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Urban Biodiversity and Design

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Foreword

The majority of the world's population lives in urban areas, which continue to expand rapidly. Although covering only about 2% of the world's surface, cities have an enormous impact on biodiversity because they account for the consumption of 75% of global natural resources and 80% of 'greenhouse' gas emissions.

Urbanization has many implications for urban biodiversity; on the one hand, the unique diversity and mosaic of habitat structures in cities supports a wide variety of animal and plant species and makes a significant contribution to the quality of life. For example, green spaces provide the only enjoyment and appreciation of nature that most of the world's population has access to. On the other hand and paradoxically, urbanization is one of the major threats to global biodiversity and environmental degradation, leading to the replacement of natural structures and homogenization.

The ninth Conference of the Parties of the Convention on Biodiversity (COP 9), which was held in Bonn in May 2008, acknowledged for the first time since the signing of the Convention in 1992, that cities are important contributors to global efforts to protect and enhance biodiversity. The decision IX/28 – 'Promoting the engagement of cities and local authorities in the implementation of the Convention on Biodiversity' – emerged from two important events during COP 9, namely, the

1. meeting 'Local Action for Biodiversity' of 50 city mayors from 30 countries in Bonn on 26 and 27 May 2008, where the representatives of over 100 million people underlined the importance of urban biodiversity;
2. conference 'Urban Biodiversity and Design – Implementing the Convention on Biodiversity in towns and cities', in Erfurt from 21 to 24 May 2008, which was attended by 400 scientists, planners and other practitioners from 50 countries. It was the first conference ever to discuss and consider the current state of scientific knowledge and practices in relation to biodiversity and the planning, design and management of the urban environment.

This book comprises the more important results from the 250 presentations at the Erfurt Conference. Although there is an increasing body of knowledge about urban ecology, it is substantially less than all other ecosystems, whilst the application of scientific knowledge to practical urban design and rehabilitation issues is very rare.

This book is the first to consider the state of current information and its application to sustainable urban development in relation to the Convention on Biodiversity. The book examines the biological, cultural and social aspects of urban biodiversity and their interaction with the abiotic environment, particularly climate change and global warming. The chapters demonstrate how a high-quality environment can be created in order to enhance biodiversity, provide attractive areas of green space, contribute to the alleviation of poverty and to improve public health.

We highly recommend this book to politicians and their officials and all disciplines involved in research, planning, design and management of the green urban environment, including biologists, ecologists, landscape architects, planners, horticulturists and urban designers.

Dr. Ahmed Djoghlaif, Executive Secretary, Convention on Biological Diversity, Montreal

Prof. Dr. Beate Jessel, President, Federal Agency for Nature Conservation Germany, Bonn

Prof. Dr. h. c. Herbert Sukopp, Honorary President of the Competence Network Urban Ecology, Berlin

Preface

Urban biodiversity is ‘the variety and richness of living organisms (including genetic variation) and habitat diversity found in and on the edge of human settlements’. This biodiversity ranges from the rural fringe to the urban core. At the landscape and habitat level, it includes

- remnants of pristine natural landscapes (e.g. leftovers of primeval forests, rock faces);
- (traditional) agricultural landscapes (e.g. meadows, areas of arable land);
- urban-industrial landscapes (e.g. city centres, residential areas, industrial parks, railway areas, formal parks and gardens, brownfields).

Urban biodiversity is determined by the planning, design and management of the built environment, which are, in turn, influenced by the economic, social and cultural values and dynamics of the human population. With the rapid growth of an increasingly urban world population, especially since the mid-20th century, urbanization has become one of the main drivers of the threat to global biodiversity. Sustainable urban development, including the management and design of urban biodiversity, is therefore of crucial importance to the future of global biodiversity.

In this context, several research programmes have been carried out recently at the University of Applied Sciences, Erfurt, to examine how urban biodiversity is considered within the Convention on Biological Diversity (CBD). Important were especially two seminal ‘events’:

1. A project carried out from 2003–2004 in which we compared how ‘Urban Biodiversity’ is incorporated within the working programme of the CBD and in the national reports of their contracting parties. The project concluded that there was a major lack of appreciation of urban biodiversity within both the Convention and the parties.
2. A conference ‘Biodiversity of urban areas – basics and examples of implementation of the Convention on Biological Diversity’ which was held in

2004 in Jena (Germany), to discuss the current state of knowledge of urban biodiversity in Germany.

These events resulted in the decision to organize an international conference to examine and debate the issues on the world stage. This International Conference ‘Urban Biodiversity and Design - Implementing the Convention on Biodiversity in towns and cities’ was held from 21 to 24 May 2008 in Erfurt (Germany) as the third CONTUREC conference (German CoMPetence Network URban Ecology). The conference had two main objectives:

1. Presenting and discussing the current state of knowledge and practice concerning biological diversity in urban areas and sustainable urban design.
2. Bringing the importance of urban biodiversity to the attention of the members of the Convention on Biological Diversity during the ninth meeting of the Conference of the Parties (the biennial follow-up to the Rio Convention) in Bonn from 19–30 May 2008.

The conference under the patronage of Ahmed Djoglaf (Executive Secretary of the Convention on Biodiversity) and Herbert Sukopp (Honorary President of CONTUREC) was unique in bringing together 400 scientists, planners and other practitioners from 50 countries around the world. Within the five main topics, 20 themed symposia were held comprising a total of 120 oral and 120 poster presentations. Additionally, four excursions were made to sites where some of the best practices relating to urban biodiversity and sustainable design could be inspected and the practical difficulties and solutions discussed. The sites were: the historic city and Bastion Petersberg in the conference city Erfurt; the UNESCO World Heritage ‘Park an der Ilm – Weimar’, the UNESCO World Heritage ‘Warthburg Castel by Eisenach’ and the ‘Naturpark Südgelände, Berlin’.

After much careful consideration and discussion by the delegates, the conference concluded with a statement to the ‘Conference of the Parties 9’ in Bonn, namely – the ‘Erfurt Declaration’. In order to continue the dialogue between scientists and the Convention on Biodiversity and in order to prepare further meetings, the participants founded ‘URBIO’ – an International Network for Education and Research in Urban Biodiversity and Design.

The overwhelming response to the conference demonstrates that it was an opportune time to hold it and to produce a book that summarizes some of the more important results.

In the introductory chapter, the current knowledge of the ecology of urban ecosystems and their biodiversity is discussed, especially in terms of why they are essential to realizing the objectives of the Convention on Biological Diversity. The subsequent chapters are arranged in five related and overlapping sections.

Section – *Fundamentals of urban biodiversity* – contains the keynote presentations of each of the five main topics of the conference and a review of ‘urban biodiversity’ literature.

Section – *History and development of urban biodiversity* – comprises five chapters that describe the evolution and distinctiveness of flora, fauna and vegetation in urban areas.

Section – *Analysis and evaluation of biodiversity in cities* – includes seven chapters that consider the analysis and evaluation methods used in the determination of urban biodiversity in terms of species and habitats.

Section – *Social integration and education for biodiversity* – has six chapters dealing with the perception of biodiversity and the integration of urban biodiversity in education.

Section – *Conservation, restoration and design for biodiversity* – contains seven chapters that describe projects in which principles of improving biodiversity have been applied.

The Conclusions that end the book outline the challenges that face biodiversity in urban areas, and advocate what needs to be done if urban biodiversity in towns and cities is not only to be maintained but enhanced.

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Introduction

Urban Biodiversity and the Case for Implementing the Convention on Biological Diversity in Towns and Cities

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Summary

Climate change, loss of biodiversity and the growth of an increasingly urban world population are main challenges of this century. With two-thirds of a considerably larger world population predicted to be living in urban areas by 2050, we argue that urban biodiversity, that means the biodiversity within towns and cities, will play an important role by holding the global loss of biodiversity. As a consequence, the Convention on Biological Diversity (CBD) must promote the engagement of cities and local authorities in future.

In the first part of this chapter, the efforts of the CBD towards urban biodiversity are analysed from their foundation in 1992 until now.

In the second part, the current knowledge of urban ecosystems and their biodiversity is summed up and the importance of urban biodiversity for global biodiversity is highlighted.

In the third part, challenges for the future of urban biodiversity are presented. These challenges were addressed to the partners of the CBD during the International Conference ‘Urban biodiversity and design – implementing the Convention on Biological Diversity in towns and cities’ held in Erfurt in May 2008.

Keywords

biodiversity, cities, convention on biological diversity, design, urban ecosystems

Background – the world goes urban

The year 2007 was a historical turning point in the development of the world population, for it was at that time that more than half of the world’s human population had come to live in urban settlements. The prediction is that by 2050, more than two-thirds of a considerably larger world population will be living in urban areas; see Figure 1.1.

Land-use changes represent the main factor in the loss of biodiversity on the local, regional and global scales. Both agriculture and urbanization are quoted as the primary driving forces that result in changes to the vegetation (and therefore of plant and animal species). Some scientists consider urbanization to be the sole cause of the threat to global biodiversity (Czech *et al.*, 2000). That is especially true if agriculture is not considered to be an independent sector but as a supplier of food for the predominantly urban population. This is linked to the question of whether, from a global viewpoint, cities should be described and evaluated primarily in terms of the 2% of the world’s surface that they cover or of the 75% of resources that they consume and the 80% of greenhouse gases that they produce (CBD, 2007). These are relevant issues when considering the ecological footprint of cities, which is likely to expand rapidly as the result of the increasing number and income of the world’s human population.

In recent years, several scientists have discovered that increasing urbanization results in a large proportion of existing plant species in urban areas being replaced by a small number of widespread and aggressive species. This process of a few winners and many losers is termed *biotic homogenization* (McKinney, 2006; Olden *et al.*, 2006). In some regions of the world, most of the invasive species are non-native, which were first introduced into cities where they got established and naturalized, and spread. Thus, cities were the principal starting points from where many of these aggressive species spread.

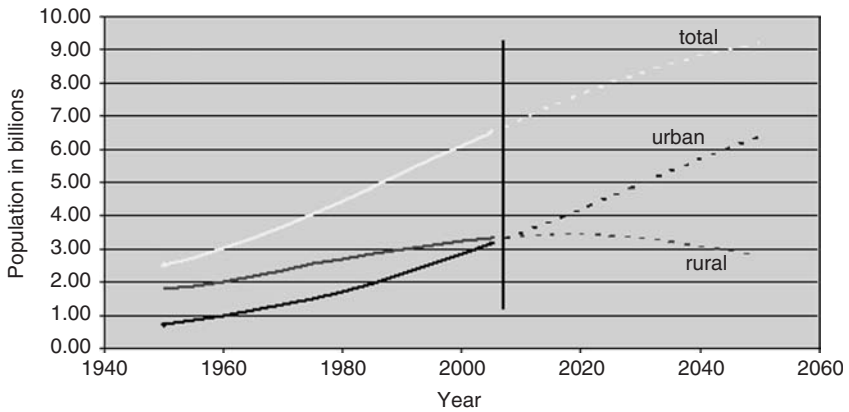
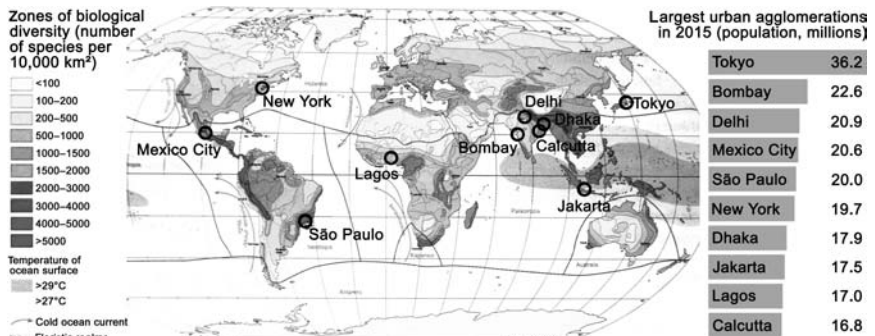


Figure 1.1 Development of world population (based on data of UN; <http://esa.un.org/unup>; last accessed 18 February 2008).

Another important issue that must be considered is that in the future, most of the urban population growth will mainly occur in the fast-developing countries in South America, Africa and Asia that have a very high biodiversity (= global biodiversity ‘hot spots’; see Figure 1.2).

Consideration of these main challenges for life on earth indicates that changes in the climate and biodiversity will drive the planning, design and



W. Barthlott, N. Biedinger, G. Braun, F. Feig, G. Kier, W. Lauer & J. Murke 1999 - changed from: W. Barthlott, W. Lauer & A. Placke 1996 :: Institute of Botany & Institute of Geography, University of Bonn / German Institute of Remote Sensing Data, Köln :: Map: M. Graf, Institute of Geography, University of Bonn

Figure 1.2 Hot spots of global biodiversity and the 10 largest urban agglomerations in 2015 (map amended from Barthlott *et al.*, 1999).

management of existing and future urban development, or to sum up in the words of the Executive Secretary of the Convention on Biological Diversity (CBD) in Curitiba 2007 'The battle for life on earth will be won or lost in urban areas' (CBD, 2007). To include sustainability by the design of cities, urban agglomerations and mega cities will be therefore a major task to solve global environmental, economic and social problems (e.g. Töpfer, 2007).

Whilst cities pose major challenges for the protection of biodiversity, the opportunities they offer have received little consideration in the global debate about biodiversity, at least so far. In principle, there are two complementary ways for cities to play their part in meeting the CBD target of stopping biodiversity loss, namely

- the sustainable use of ecosystem goods and services for and within cities;
- the conservation of biodiversity within towns and cities and the sustainable design of all urban areas to maximize their ability to support biodiversity.

This chapter will give an introduction to the second target which was also the focus of the International Conference 'Urban Biodiversity and Design – Implementing the Convention on Biological Diversity in towns and cities' held from 21 to 24 May 2008 in Erfurt, Germany.

Firstly, we will give a short summary in the so far unsuccessful efforts to add the item 'biodiversity and cities' on the agenda of the Convention on Biological Diversity.

Secondly, we will present an overview of the scientific view of urban ecosystems and will highlight the importance of urban biodiversity for global biodiversity.

Finally, the challenges and opportunities for the future of urban biodiversity are summarized, as a recommendation of the above-mentioned conference.

History of urban biodiversity within the Convention on Biological Diversity

The Conventions on Biological Diversity and Climate Change were concluded in Rio de Janeiro on 5 June 1992 and has been ratified by 191 nations. They are the most important international environmental conventions of the late 20th and early 21st centuries.

The aims of the CBD are as follows (UN, 1992):

- The conservation of biological diversity; maintaining the earth's life support systems and future options for human development
- The sustainable use of its components, that means providing livelihoods to people, without jeopardizing future options
- The fair and equitable sharing of the benefits arising from the use of genetic resources

The impact of urbanization on biodiversity and other natural resources was considered by the CBD in 1992 and has been discussed at the subsequent nine 'Conferences of the Parties'. Whilst cities pose major challenges to the protection of biodiversity, the opportunities they offer have received little consideration, at least until now. An exception was the sixth Conference of the Parties (COP 6) in The Hague in 2002, when it was recommended that part of the COP 9 should focus on the issue 'Biodiversity of urban & suburban areas'. However, during the seventh COP in Kuala Lumpur in 2004, the topic was postponed indefinitely.

Cities are centres of economic, financial, social and political power, as well as of culture and innovation. They are also the places where most people have the most contact with nature. In this sense, cities are not only the problem but also the solution to the global challenges such as the CBD target of stopping biodiversity loss by 2010. A major step towards recognizing the potential of cities for increasing biodiversity was made in Curitiba in March 2007, when 34 mayors and many of their senior officials from cities across four continents initiated a global partnership to promote 'cities and biodiversity' with the objective of encouraging local authorities to implement the CBD. The 'Curitiba Declaration', adopted at the meeting reaffirmed the urgency that is needed to achieve the CBD objectives in urban areas and to engage local authorities for the 'Battle of life on Earth.' Particular emphasis was placed on raising public awareness and educating future generations, as well as on disseminating best practices and lessons learned through cooperation between cities. In order to provide a forum for the exchange of knowledge and experiences, the Declaration also recommended the establishment of a 'clearing house' mechanism within the Secretariat of the CBD. The participants mandated a steering committee, comprising mayors from each of the four continents to take the lead in engaging local authorities in the implementation

of the CBD and to participate in the municipal pre-conference of the ninth meeting of the COP that was held in May 2008 in Bonn (SCBD, 2007).

At the COP 9 in Bonn, Germany in May 2008, the parties discussed the role of local authorities in the implementation of the CBD and for the first time, adopted a decision on cities and biodiversity (Decision IX/28). This decision encourages the 191 parties to the Convention to recognize the role of cities in national strategies and plans, and invites the Parties to support and assist cities in implementing the Convention at the local level. Indeed, one of the greatest achievements of the ninth meeting of the COP is the recognition that the implementation of the three objectives of the CBD requires the full engagement of cities and local authorities. A plan of action on cities and biodiversity will be submitted at the 10th meeting of the COP, to be held in Japan, in October 2010, the International Year of Biodiversity. A Nagoya summit on 'Cities and Biodiversity' will be convened during the meeting. This important decision was based on two events that occurred during the ninth COP meeting in 2008, namely

- the International Conference on 'Urban Biodiversity & Design' in Erfurt, uniquely brought together almost 400 scientists and practitioners from 40 countries. Ecologists, planners, designers and managers discussed how to implement the CBD in towns in cities. At the end of the conference, they united in issuing the 'Erfurt Declaration' and promised to support the CBD initiative through their network 'URBIO' and further meetings on the subject (for example Urbio 2010, which will be held in Japan in 2010);
- the 'Mayor's Conference on Local Action for Biodiversity' was held on 26–27 May 2008 in Bonn, where over 50 mayors and other senior local government officials discussed strategies, activities and experiences relating to 'Biodiversity and the Urban Space' and adopted the 'Bonn Call for Action'.

Characteristics of urban ecosystems

Alterations to local climate, soil, water and biodiversity

An urban area can be defined by applying the following criteria (Sukopp & Wittig, 1998; Pickett *et al.*, 2001).

1. Human population larger than 20,000 and with a population density (in the central area) greater than 500 persons/km²