Human-Environment Interactions 3

Christopher G. Boone
Michail Fragkias *Editors*

Urbanization and Sustainability

Linking Urban Ecology, Environmental Justice and Global Environmental Change

Springer

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VOLUME 3

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ISBN 978-94-007-5665-6 ISBN 978-94-007-5666-3 (eBook)
DOI 10.1007/978-94-007-5666-3
Springer Dordrecht Heidelberg New York London

Library of Congress Control Number: 2012955482

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

In the Anthropocene era, human activity has altered biophysical systems on a planetary scale, accelerating species extinctions, radically changing land cover, and contributing to rising global temperatures. Over the last half century, there has been growing recognition that the ability of earth's ecosystems to support unbridled resource use is limited. Indeed, many biophysical processes on which we depend are presently overburdened, creating new uncertainties about the long-term viability of societies. The grand challenge for the coming decades will be to transform the ways we think about and act upon the relationship between people and the environment in order to transition toward a sustainable future.

In this book, we focus on three themes that, when combined, contribute to sustainability scholarship and practice. The first is global environmental change, understood not as unidirectional human degradation of the biophysical world, but as the integration of social and ecological dynamics on multiple spatial and temporal scales. Global environmental change is meaningful only when we incorporate the feedbacks, cascading effects, thresholds, lags, and interactions between societies and ecosystems.

The second theme is urbanization. We live in the Anthropocene, but we are also living in the urban century. Cities are and will continue to be the primary human habitat, and urbanization processes will drive and respond to the challenges posed by global environmental change. Growing urban populations can create negative pressures on global ecosystems, but as centers of innovation and increased productivity, cities can also be the seedbeds of solutions to global sustainability challenges.

The third theme of the book is justice. Urbanization and global environmental change have created gross inequities, with some people, often the most vulnerable, suffering a disproportionate burden of ill effects. A focus on justice, however, can ameliorate existing and future inequities while addressing the fundamental normative underpinnings of sustainability.

Sustainability means more than surviving – it is about envisioning a desirable albeit plausible future and working toward that goal. The future will be urban and dependent on careful management of socio-ecological systems from local to global

scales and from near to distant time horizons. We argue in this book that justice is a desirable sustainability goal, both from a moral stance and as a framework for reenvisioning the future of urbanization and global environmental change.

This book stems from a workshop on linking ecology, environmental justice, and global environmental change that we organized for the Open Meeting of the International Human Dimensions Programme on Global Environmental Change (IHDP) in Bonn, Germany, in 2009. IHDP is an interdisciplinary international scientific program that catalyzes and coordinates research on the human dimensions of global environmental change. Efforts focus on research, building research capacity, and international scientific networking. IHDP works at the interface between science, policy-making, and funding agencies to coordinate and generate scientific knowledge on socio-environmental systems and advance understanding of global environmental change processes and the consequences for sustainable development. At the 2009 IHDP Open Meeting, Fritz Schmuhl from Springer Press encouraged us to consider a book project based on the workshop theme. In addition to his patience, we are very thankful for his guidance and encouragement in seeing this project through to completion.

We have benefitted a great deal from being part of the Urbanization and Global Environmental Change (UGEC) project, a core initiative of the IHDP. The UGEC project has been an international leader in promoting the science and practice of urbanization and global environmental change. UGEC, through diverse science coordination actions, has helped shift scholarly attention toward gaps of knowledge regarding the bidirectional interactions and feedback loops between urban areas and the global environment. Many of the ideas in this volume originated in conversations with UGEC steering committee members, project associates, and in meetings supported by the project internationally. The National Center for Ecological Analysis and Synthesis, sponsored by the US National Science Foundation, provided support for three workshops that were incredibly fruitful in developing our thinking on the main themes of the book. The Baltimore Ecosystem Study and the Central Arizona Phoenix Long Term Ecological Research projects, supported by the US National Science Foundation, have helped us push the boundaries of urban environmental research and thinking. We also wish to express our thanks for the continued support of the Global Institute of Sustainability and the School of Sustainability at Arizona State University. As well as housing the UGEC International Project Office and providing key financial support, the institute and school have created a stimulating hub of thinking and practice on sustainability science. This book is very much an offspring of that unique and vibrant marketplace of ideas.

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Chapter 1
Towards a New Framework for Urbanization and Sustainability

Michail Fragkias and Christopher G. Boone

Abstract This chapter describes the overall framework that links literatures, ideas, and scholars from urban ecology, environmental justice, and global environmental change; these subdisciplines have so far remained largely separate but have great potential for intellectual synergy.

Keywords Urbanization • Urban ecology • Environmental justice • Global environmental change

1.1 Introduction

The social, economic and physical transformation dimensions of urbanization make it "one of the most powerful and visible anthropogenic forces on Earth" (Sánchez-Rodríguez et al. 2005). Many of the most important and significant changes associated with the impact of globalization are taking place in urban areas (ibid. 2005). Already habitat for half of humanity, cities will absorb more than 90% of future

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C.G. Boone and M. Fragkias (eds.), *Urbanization and Sustainability: Linking Urban Ecology, Environmental Justice and Global Environmental Change*,
Human-Environment Interactions 3, DOI 10.1007/978-94-007-5666-3_1,

population growth, most of which will occur in poor countries (United Nations Population Fund 2007). Rapid population growth concentrated in urban areas has significant implications for the long-term outlook for people and the planet. Urban areas are increasingly subject to new challenges and rising social and environmental inequities, especially in poor countries; but urbanization offers opportunities for developing sustainable solutions to pressing global environmental and social issues. (Sánchez-Rodríguez 2005).

This book links literatures, ideas, and scholars from urban ecology, environmental justice, and global environmental change that have remained largely separated but have great potential for intellectual synergy. Urban ecology has undergone significant transformations in the last decade as participants have shifted from a focus on ecology *in* cities to ecology *of* cities (Grimm et al. 2008). Treating cities as ecosystems in which people and the built environment are integral has opened possibilities for linking ecological and social dynamics. To date, however, most urban-ecological studies have focused on local systems. Scaling up findings from experimental plots to metropolitan areas has been a significant challenge, and few have linked to regional or global scales.

As a field, urban ecology has been wary of using scientific findings for advocacy, yet there is enormous potential for using such research to reach normative goals for a sustainable future. In contrast, environmental justice researchers (and activists) have been quick to use science to call for action. Over the last 30 years, environmental justice research has revealed how marginalized groups (ethnic minorities, indigenous groups, people in poverty) typically bear most environmental burdens. A variety of groups have used such research to shut down polluting facilities or reduce the emission of harmful chemicals. The environmental justice community has also called for fair treatment and representation in environmental decision-making bodies. However, many have noted (see Chap. 3 by Pickett, Boone, and Cadenasso) that there is little "environment" in environmental justice, as most research and action has focused on the impact of human activities, such as polluting industry, on other human beings. In addition, a great deal of environmental justice research and action centers around single, local case studies. Similar to urban ecology, most environmental justice research has not scaled up to generalize about environmental justice processes at regional or global scales. While the environmental justice movement has expanded to other countries, the vast majority of research is based in the United States, and few studies link local struggles to larger global processes. Global environmental change (GEC) research, on the other hand, works to explicitly link local and global and human and natural processes. While GEC offers an integrative framework, it could benefit from the detailed scientific work of urban ecology and the explorations into social dynamics and normative stances of environmental justice. Most critically, by linking ideas, theories, and frameworks from the three fields, this book will offer new insights on promising integrated pathways toward urban sustainability (see Chap. 4 by Boone and Fragkias).

1.2 Progress So Far: A Landscape of Thematic Linkages

Urban areas are complex, dynamic systems that reproduce and are produced by interacting socioeconomic, geopolitical, environmental, and ecological processes at multiple scales. These interactions create a diversity of impacts that can be grouped into two broad categories: those originating in urban areas that affect global environmental change and global environmental change that affects urban areas. Urbanization has started to become visible in the analysis of global environmental change, but the majority of research continues to focus on how urban areas impact global environmental change. In particular, the bulk of GEC research has focused on urban contributions to greenhouse gas emissions and biodiversity loss. Increasingly, however, more attention is being devoted to the study of the impacts of global environmental change on urban areas and the people who live in them, as well as responses in urban areas to GEC.

In discussing global environmental change, we should not overlook the change of human living conditions that has occurred through the global shift from rural to urban settlements – a defining global trend of the last 100 years. Importantly, most of the future world population growth up to 2030 is projected to occur in the rapidly growing cities of poor African and Asian nations (around 80% of the total) as well as in Latin America. Africa is urbanizing more quickly, and Asia is urbanizing with larger absolute gains than the rest of the world's regions. In China over the next 15 years, 350 million people will be added to cities, a number larger than the current total population of the United States. This will bring the total urban population in China to one billion, while increasing the number of cities with more than a million to 221. While we expect an increasing number of megacities (cities with population of over 10 million people), they are expected to contain approximately the same proportion of the world's urban population – around 15%; the majority of future urbanites will live in rapidly growing medium-sized or small developing-world cities, subject to many present-day urban pathologies (UN 2008). Not only will urban areas of primarily medium size absorb the majority of future urban growth, but the majority of the new urban residents are expected to be poor. While slums already constitute about 41% of urban living configurations in the developing world, urban growth in certain regions will come about with the formation of new slums. The actual effect of climate change on poor and vulnerable urban residents will depend on multiple stressors and a confluence of factors, such as the level of economic development of a city and its nation, the pace of demographic change, various ecosystem factors, urban spatial structure and function, and the wider institutional setting.

Today it is clear that urbanization is occurring faster and at larger volumes in locations that are at lower stages of economic development and face rapid demographic changes. City systems will continue to disproportionately affect ecologically fragile areas and contribute to the loss of agricultural land compared to other systems.

Urban growth is expected in coastal and arid ecosystems, particularly sensitive to the effects of climate change. Sprawling urban development is projected as a dominant trend (although this could be reversed by spikes in oil prices). Urbanization hotspots lack functions such as durable housing, access to improved water, key resources, and sanitation and suffer from the ill effects of overcrowding, high levels of unemployment, and social marginalization. Institutional support in these hotspots is typically weak and ineffective, lacking the rule of law and accountability while hampered by endemic corruption. Such factors, operating in concert with climate change impacts, create "stress bundles" that increase the probability of climate change as a dangerous phenomenon. These stresses are not confined to urban areas. Since cities connect nodes of production and consumption in regional and global networks, climate change stresses can ripple through other places and wider regions (Sánchez-Rodríguez et al. 2005).

Climate change is currently at the forefront of GEC realities. Through the efforts of communities such as the IPCC and its 2007 4th Assessment Report, we know that the increase in globally averaged temperatures is indisputable and that since the mid-twentieth century is very likely (90–99% chance) that most of the increase is anthropogenic. Other than the general increase of temperatures, sea level and frequency of natural catastrophes, and levels of economic losses, the collection of available conservative climate change models shows that it is very likely that hot extremes, warm spells and heat waves, will continue to become more frequent over most land areas; that heavy precipitation events will become more frequent over most areas; that it is likely that the area affected by droughts will increase; and that future tropical cyclones will become more intense, with larger peak wind speeds and heavier precipitation but uncertain change of total number (IPCC 2007).

Urban areas have begun to be considered a central element in the responses to climate change during the last few years due to a combination of factors of opportunity and risk. As the rapid urban transition to four billion urban inhabitants worldwide will occur (three-quarters of the population) by 2030, particularly in poor countries, the fact that between 50 and 80% of GHG emissions already originate in cities comes sharply into focus. On a positive note, cities are (or can be) places of economic growth and social well-being, important nodes for today's globalization, and the nexus of production, commerce, and gateways to the world's economy (Sanchez-Rodriguez et al. 2005). They are also potentially efficient users of infrastructure and resources due to economies of scale, promoters of more efficient urban forms and functions, and prime spaces for intervention. In cities there exist opportunities to change production and consumption patterns in order to reduce adverse effects on GEC and promote renewable sources of energy. Local strategies in metropolitan areas can lead to more local and global sustainable solutions.

Scholars have begun to explore complex links between ecology and environmental justice through new integrated, collaborative, transdisciplinary, and synthetic research on the dynamics of socio-ecological systems. In bridging the gap between ecology and environmental justice (EJ), researchers have focused on the intersection of questions on how to deal with limited resources and ecosystem services and how to increase equity and establish social cohesion at various levels; several key

components of EJ are relevant (Shrader-Frechette 2002; Pickett et al. 2007). First, and at the core, is the component of distributive justice, which seeks to understand the distribution of environmental benefits and threats in relation to social groups, defined most often by race, ethnicity, and class. In many cases globally, communities characterized by both ethnic and class disadvantage live near environmentally threatening sites or under the threat of various environmental hazards. Second is the issue of participative justice, examining fairness and participation in environmental decision-making. At the local level, voices of marginalized groups are frequently not heard even in cases that have a direct bearing on marginalized groups' local environmental conditions, livelihoods, and quality of life. Transnational waste transfers and "biopiracy" of genetic material by international agencies and corporations are two global scale examples of participative injustice, where affected parties have little to no voice in decisions and actions (Pellow 2007).

While international pressure mounts for fast action toward established greenhouse gas (GHG) emission targets, populations with threatened livelihoods due to irreversible climate change and its expected shorter-term effects have to start considering adaptation options. As is the case with the majority of environmental problems facing humanity, anthropogenic climate change affects disproportionately the poor and marginalized across different scales – regions, nations, cities, and neighborhoods. While clearly climate change effects result in both winners and losers, the nations and cities that have been the largest emitters of GHGs for the last 100 years will not experience the bulk of the negative effects of climate change. The "goods" and "bads" of anthropogenic climate change are not distributed uniformly across populations in the developed and developing world or even across populations within developed countries and LDCs. Poor nations and populations have a reduced or nonexistent adaptive capacity that would help them protect themselves from the effects of climate change and thus face increased levels of vulnerability. At the same time, poor and marginalized urban residents worldwide often do not have a strong voice in the political arena with resulting weak representation in national and subnational policymaking. Environmental justice offers a mature and robust framework for citizens, policymakers, and scholars to understand the patterns and dynamics of uneven consequences of global and local environmental change.

1.3 Toward a Synthesis

This book adopts a broad view of environmental justice that incorporates distributive and participative justice, as well as an understanding of the social, economic, political, and cultural contexts of environmental problems, struggles, and resistance. It advances environmental justice scholarship by linking it to ecology and global environmental change and in doing so provides a framework for urban sustainability that is just and equitable (Boone 2008).