

LIFE AFTER CARBON

The Next Global Transformation of Cities

PETER PLASTRIK
JOHN CLEVELAND

Copyright © 2018 Peter Plastrik and John Cleveland

All rights reserved under International and Pan-American Copyright Conventions. No part of this book may be reproduced in any form or by any means without permission in writing from the publisher: Island Press, 2000 M St. NW, Suite 650, Washington, DC 20036

Island Press is a trademark of The Center for Resource Economics.

{~? ~TN: Library of Congress and CIP Data TK from production}

All Island Press books are printed on environmentally responsible materials.

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2 1

Keywords

Austin, Berlin, biophilic urbanism, Boston, Boulder, C40, Cape Town, Carbon Neutral Cities Alliance, climate change, Copenhagen, London, Melbourne, Mexico City, Minneapolis, New York City, Oslo, Paris, Portland (OR), renewable energy, Rio de Janeiro, Rotterdam, San Francisco, Seattle, Shanghai, Singapore, Stockholm, sustainable cities, Sydney, Toronto, transit, urban resilience, Urban Sustainability Directors Network (USDN), Vancouver, Washington, DC

FOR URBAN CLIMATE REBELS,

—

our friends, tribe, and inspiration

*You take delight not in a city's seven or seventy wonders,
but in the answer it gives to a question of yours.*

—ITALO CALVINO

Gaia is a tough bitch.

—LYNN MARGULIS

*People are unlikely to jettison an unworkable paradigm,
despite many indications it is not functioning properly,
until a better paradigm can be presented.*

—THOMAS KUHN

CONTENTS

<i>Prologue: Creation Stories</i>	xi
Introduction	1
Part I: On the Innovation Pathway	
01 Innovation Proliferation	15
02 Urban Climate Innovation Laboratories	23
03 Goals, Systems, Clusters, and Waves	31
04 Making a Better City	53
05 The Rebel Alliance	59
Part II: Toward Global Transformation of Cities	
06 The Power of Transformational Ideas	67
07 Carbon-Free Advantage	85
08 Efficient Abundance	107

09	Nature's Benefits	133
10	Adaptive Futures	155
Part III: The Road Ahead		
11	New Thinking Spreads	171
12	Continuous Innovation	185
13	A New Urban Future?	207
	<i>Epilogue: Time Is Our Frenemy</i>	215
	<i>Acknowledgments</i>	219
	<i>Notes</i>	223
	<i>General Index</i>	267
	<i>About the Authors</i>	279

PROLOGUE

Creation Stories

Our blue planet has become an urban world. Thousands of cities cover the surface of the earth, housing most of humanity and its economic activities. These are modern cities—developed in much the same mold since the early 1800s, when the world turned to fossil-fuel energy to drive the Industrial Revolution’s technologies and globalized markets, urbanization, and pollution.

But the modern city model has outlived its usefulness. It cannot solve the very problems it has helped create, especially global warming. In response, cities worldwide have developed waves of innovations—new policies, programs, tools, business models, and more—to prevent long-term climate damage. Cities that are leading the way—those most fully committed, ambitious, and inventive—are rejecting and replacing basic ideas upon which the modern city was built.

This is not the first time cities have reinvented themselves. It is the next time.

Our story starts in a sacred place in a pioneering city where the arc of the modern urban paradigm is revealed, from its origin before living memory to the beginning of its replacement in our time.

On a riverbank in Australia, our Aboriginal guide sings the birth of a modern city.

“Where all the skyscrapers are right now was a eucalyptus farm,” recounts Dean Stewart, of Wemba Wemba-Wergaia heritage, motioning toward the glass-and-steel buildings framing the river’s west side. “You’d have bullrushes and water reeds all around this area,” as well as mangrove and red gum trees, kangaroos, koalas, pelicans, blackfish, dolphins, and thousands of indigenous people.

At this very spot, he says, “an ancient waterfall a meter-and-a-half tall completely cut this river in half,” separating freshwater upstream from the ocean’s salty water.

Stewart sways rhythmically, his eyelids fluttering under a New York Yankees baseball cap, as he points into the dark waters. There, he says, the cascade’s stones provided a passage across the river: “This waterfall was like an umbilical cord that physically connected the entire traditional population of this region for thousands of years.” It was more than a place to walk over: “It had profound spiritual significance for the entire humanity of this area. Every single one of us would know the ancient creation story of the waterfall. We’d know the music of this ancient river system in front of us. We’d know the songs of the mountain ranges, the music of the landscape, of the animals, of the plants. Everything was animated and bound through songs and stories.”

Stewart’s voice competes with the swelling noises of traffic, pedestrians, and construction. “Listen,” he instructs his audience of about forty people from cities on five continents. “These are exactly the same sounds you hear in any major city around the world. These modern city sounds can drown out our ability to connect with country, to connect with place. One of the biggest challenges for us, as city slickers, living our urban lifestyle, is to make some of those connections. Two hundred years ago, you’d be hearing the sound of this ancient river tumbling over the waterfall right here.”

Not anymore. In 1835, white settlers arrived on the scene for the first time, rowing up to the waterfall. They founded Melbourne, laid out a street grid alongside the river they called the Yarra, and brought in thousands of sheep, cows, and horses. “Right here, literally, travelers from another world with unimaginable technology and a completely different skin color landed and changed everything forever,” Stewart says. “For the Aboriginal civilization that had been here for 50,000 years, this is ground zero.” When gold was discovered inland, tens of thousands of fortune seekers from around the world descended on Melbourne, turning a sleepy village into a boomtown. The city dynamited the waterfall to allow boat traffic to get up and down the river and to reduce periodic flooding. “By blowing up the waterfall,” Stewart says, “they blew up the ancient creation story and the song of this region as well.”

The Melbourne that arose embraced a radically different creation story, a tale of industry, commerce, and economic wealth, development, consumption, and growth driven by fossil-fuel energy. This is the story of the modern city, emerging in the nineteenth century with the Industrial Revolution, first in London, and spreading worldwide ever since, now the common habitat for half of humanity. Today more than 4.6 million people live in greater Melbourne, which consists of thirty-one municipalities along the Yarra River and nearby coast. During the week, hundreds of thousands of people commute into the central city, whose buildings ascend from the street grid laid out more than 180 years ago. Like many twenty-first-century cities, Melbourne's population is growing fast, and the city is firmly embedded at the high end of the global economy, with direct flights to Beijing, Los Angeles, Shanghai, and Vancouver. The benefits produced by modern Melbourne are evident: the city's systems house, feed, protect, transport, and employ people at an enormous scale probably never imagined by the place's indigenous people or feasible under their social and economic structures.

Stewart leads the group along a bridge where the waterfall once stood and walks over to a river-wall. "Look over the edge and down," he instructs. "The tide is out a bit so you can see that, for whatever reason, some of the big ancient rocks that made up those waterfalls—incredibly—are still here today. Guys, those rocks are an ancient human culture site. They were used by Aboriginal families in their bare feet before Jesus Christ, Moses, Mohammad, and Abraham were even born." He motions toward nearby pedestrians on the sidewalk and crowds of people in riverside restaurants: "Most Melbournians wouldn't even know those rocks are there."

Wrapping up the walk, Stewart takes the group to a small grassy area surrounded by concrete walkways. Imagine, he says, that this is still the wetland it was two hundred years ago, and we're going to cross it—but not as a crowd: "We're going to go traditional—walking single file, many people with a single footprint." Otherwise, he says, "When you walk, you've just crushed every egg, every nest, destroyed every plant, scared all the bird life and fish away. You've scared away your lunch and your dinner, not just for yourself, but for your whole community."

Yet it is in the very swarms of people moving unsustainably and unaware through this most modern of places that Stewart finds hope for the future. For hundreds of years, he says, people have been eating and socializing at this riverside spot: “It might be craft beer and red wine now, but what we’re doing is something absolutely ancient. I find this an inspiration. In our modern, capitalistic world, we are still drawn to exactly the same place. We’re still doing exactly the same thing without even realizing it. The land is still calling us to it.”

Many other modern cities appear in the pages that follow. To find ideas that respond to the existential dangers of climate change, they are looking back in history to indigenous ways of working with nature and to forgotten ways of consuming resources without producing waste. They are also looking forward to using advanced technologies that tap the earth’s renewable bounty and “smart” technologies that efficiently manage a city’s metabolism, its use of materials and energy. And to sustain the benefits of modern city living, they are learning how to prepare for a future rendered uncertain by Gaia’s response to the industrialization and urbanization that built Melbourne and other modern cities across the globe.

INTRODUCTION

The key task now is to tell a new story; of what it is to be a human in the 21st Century.

—GEORGE MONBIOT

A new urban model is emerging worldwide—transforming the ways cities design and use physical space, generate economic wealth, consume and dispose of resources, exploit and sustain the natural ecosystems they need, and prepare for the future.

The model is upending the pillars on which our modern cities were built. It is most evident in several dozen cities, half of them in the United States, that are widely regarded as leaders in making extraordinary efforts to prevent global warming and protect themselves from climate turbulence. These pioneering cities—we call them *urban climate innovation laboratories*—are trying, in just a few decades, to eliminate fossil fuels from their immense, complex systems of energy supply, transportation, buildings, and waste management. Just as systematically and rapidly, they are preparing their built infrastructures, ecosystems, economies, and residents to handle the grave impacts of extreme storms, rainfall, heat, drought, and rising seas—conditions already experienced by many cities and projected to get much, much worse.

A city innovation lab isn't a facility with highly controlled conditions, high-tech equipment, and scientists in white coats. It's not a loft full of computer-savvy urban pioneers holding all-night hack-a-thons. The laboratory is the *entire city*, the complex, real urban world with its messy swarms of businesses, governments, and organizations; urban systems; ideas, interests, and politics; built infrastructure, natural ecosystems, economic sectors; and, of course, all

manner of people and groupings. These city labs exist on every populated continent but are concentrated mostly in the US, Canada, China, western and northern Europe, Australia, and Japan. Most are well-known global cities, including Austin, Berlin, Boston, Copenhagen, London, Minneapolis, New York City, Oslo, Paris, Portland, Rotterdam, San Francisco, Seattle, Shanghai, Singapore, Stockholm, Sydney, Toronto, Vancouver, and Washington, DC. Some are smaller, high-spirited cities like Boulder and Melbourne. Several—Cape Town, Mexico City, and Rio de Janeiro—are stepping energetically onto the world climate stage.

These cities are innovating aggressively and radically—by developing and implementing experimental projects, tackling entire urban systems, and reweaving the physical and cultural fabrics of their entire respective cities. Their numerous innovations contain a set of profound ideas that are changing each city’s wealth, metabolism, ecology, and identity. These ideas contain the seeds of a new urban paradigm that is reshaping what people think a city can and should become. They introduce new ways for cities to compete successfully in a global twenty-first-century economy that is shifting to renewable energy. They herald new ways for cities to more efficiently use the vast quantities of energy and materials they need. They announce new ways for cities to value and obtain the benefits their wetlands, forestlands, open spaces, and other ecosystems provide. They signal new ways for cities to develop the social and physical adaptability needed to anticipate and prepare for uncertain future conditions.

Many of these ideas have been hovering offstage, even for decades, looking for traction in cities. They were incubated within conceptual frameworks for sustainable development, environmental services, eco-efficiency, urban metabolism, and New Urbanism; or the urban agendas of UN-Habitat and the Club of Rome’s Earth Charter; or thought-leader formulations such as the “economy of cities” revealed by Jane Jacobs, the Cradle to Cradle™ principles of designer William McDonough, the “biophilic urbanism” of professor Timothy Beatley, and Jeremy Rifkin’s economic vision of the third Industrial Revolution. Now they are being moved onto the world’s urban stage by leading cities responding to the imperatives of climate change. They are spreading to other cities, carried through

robust global networks that share information, support innovation adoption, and collaborate on further experimentation. At the same time, the mounting “climate-smart” requirements of consumers, corporations, investors, professions, and state and national levels of government are forming enabling conditions that accelerate and globalize the trajectory of this urban evolution.

Since cities were invented some six thousand years ago, they have often evolved fundamentally in response to war and conquest, trade and technologies, earthquakes and other natural disasters, as well as demographic shifts, social reforms, and political revolutions. This time, climate change is driving a full-scale evolution.

The earth’s climate has changed drastically many times throughout the planet’s long lifespan, but not in the relatively short epoch of city building. “During our entire 6,000-year history as a civilized society, we humans have lived in warm stable climatic conditions,” notes Will Travis, former executive director of the San Francisco Bay Conservation and Development Commission. “No great amount of ice was freezing or melting so, except for waves and tides, sea level wasn’t going up or down.” Most cities arose near water, especially along seacoasts—where an estimated one-hundred-million-plus Americans and six hundred million Chinese live today, most of them in cities. Now these and inland cities face unprecedented climate dangers.

The new urban model is still in an early stage of emergence. Its elements have not yet been fully defined and assembled into a coherent practice by cities. It has not yet locked in as the comprehensive new way of doing business in cities, and it faces considerable obstacles. The fossil-fuel sector continues strenuous political resistance to sweeping changes, and many national and state-level governments have failed to pursue sensible policies. Cities have limited control over many factors needed to implement radical innovations. Many city residents are reluctant to embrace changes that alter their lifestyles or cost them more money. Even the most forward-looking and capable cities sometimes struggle to develop the technical competencies, financial capital, and community constituencies needed to move forward aggressively.

Life after Carbon is an exercise in future mapping. It starts at the edge of the known world of urban climate action—the profusion

of innovations that cities are developing using technical know-how, robust information sharing, and full-throated advocacy for change. Then it looks down the road these cities are traveling on and offers a framework for the ideas and applications that are propelling them toward a new urban future. The map we offer is not a picture of what should be happening; we leave that advocacy to others. Nor is it a prediction about what will happen; on most days, the world seems too turbulent to tell with any confidence whether it will ascend to a new order or descend into chaos. Instead, the map is a projection of possibilities grounded in what is already happening in cities.

We bring together what many urban innovators in numerous cities are thinking and doing and propose that they have begun to invent a different way for a city to be a city. We describe this future destination and illuminate a pathway, still being constructed, for getting there.

In coming years, cities around the world will need to undertake far more radical decarbonization and climate adaptation strategies than they have tried so far. Our hope is that the framework we provide supports their pursuit of this next generation of changes. It serves as a benchmark against which to assess whether a city's plans and decisions can have maximum beneficial impact for the city or whether opportunities are being missed. It can help cities recast the purpose of their climate-change efforts into the broader goal of creating a better city for current and future generations of residents. Presented in this light, a city's climate strategies can resonate more with the public and stakeholders. Innovation lab cities have already recognized that their climate innovations are generating positive side effects such as the creation of "green" jobs and the reduction of air pollution, waste, and energy costs. But only a few cities have offered their residents a tangible and comprehensive picture of their city's future in an era driven by the energy revolution and climate turbulence. The story we tell in *Life after Carbon* can arm cities with a compelling narrative about themselves and their futures.

Since 2009, we have worked with many of the cities best known for designing and implementing climate innovations. We have helped

these cities' leaders team up across the United States and globally to advance their innovation processes. As advisors and enablers, we've gotten to know hundreds of city climate innovators across greatly different contexts—all part of a new international community of urban climate practitioners. We've shared firsthand in their many successes and frustrations and have admired their tenacity in the face of difficulties and setbacks.

We joined representatives of seventeen leading cities inside the Dome of Visions, a temporary geodesic structure erected along Copenhagen's waterfront, and helped them form the Carbon Neutral Cities Alliance (CNCA), a global research-and-development network pursuing innovations for radical decarbonization in cities. We guided climate-change leaders from thirty-three cities worldwide—from Cape Town to Paris, Rio de Janeiro to Shanghai—through study tours of four US cities (Austin, Boston, San Francisco, and Washington, DC) whose content we developed and delivered. We've advised some of the leading US philanthropic investors in urban climate action, helping shape the granting of tens of millions of dollars. We've debriefed city climate innovators around the world to produce reports about the edge of urban innovation for reducing greenhouse gas emissions and preparing for climate disruptions. Especially important to the development of our insights has been John Cleveland's "deep dive" into Boston's carbon reduction and climate preparedness as executive director of its Green Ribbon Commission, a world-class group of business, institutional, and civic leaders.

We know many of the questions that cities are asking about the various challenges involved in climate innovation, including: How can we obtain even bigger reductions in greenhouse gas (GHG) emissions? How can we decide how much sea-level rise to plan for? How can we pay for innovations? How can we develop more and sustained local political support for change? How can we ensure that the costs and benefits of climate action are distributed fairly in the community? How can we enlist other governments in the metropolitan region to the cause?

This book's starting question is different from these questions. In what way, it asks, is the remarkable proliferation of urban climate

innovation, with all its creativity, successes, and challenges, changing the fundamental nature of cities?

Innovation by cities is an age-old phenomenon. The experiments of ancient cities produced profound and enduring advancements: markets, democracy, libraries, bureaucracy, universities, and writing. Cities “have been engines of innovation since Plato and Socrates bickered in an Athenian marketplace,” notes urban economist Edward Glaeser. “The streets of Florence gave us the Renaissance, and the streets of Birmingham gave us the Industrial Revolution.”

But cities are more than platforms for innovation; they, themselves, are an innovation. Born out of experimentation thousands of years ago, they are a great and sustained invention that reveals, realizes, and refines the collaborative potential of our species. “At the brink of recorded history,” explains Lewis Mumford in his masterpiece, *The City in History*, “a great urban transformation took place.” It was an implosion of human power: “The many diverse elements of the community hitherto scattered over a great valley system and occasionally into regions far beyond, were mobilized and packed together under pressure, behind the massive walls of the city.”

This innovation, “the city,” keeps changing, in a continuous evolution from its origin in the simple Neolithic village to its manifestation as the complex modern metropolis. But the urban essence remains: the city is a dense collective of human energy and talent that in a defined geography and governance boundary develops a thickly built living environment, exploits natural ecosystems near and far, spatially organizes social distinctions and cohesion, and generates economic wealth.

The city is more important than ever. When the modern city began to develop around 1800, there were few large cities. Demographers say that only about 3 percent of the world’s one billion people lived in cities. Just a few cities—London, Beijing, Tokyo (known then as Edo), Baghdad, and Istanbul among them—had ever contained as many as one million residents. In North America, only Philadelphia held more than forty thousand people. When Britain invaded New York City in 1776, its force of thirty-two thousand soldiers outnumbered the city’s inhabitants.

Now, though, 3.9 billion people live in cities—more than half the world’s population—and millions more arrive every month

by birth or migration from rural areas and small towns, in search of economic advancement or personal development. In the US, about three hundred cities each have one hundred thousand or more residents. Worldwide, more than five hundred cities contain at least one million people, and there are thirty-one “megacities” with more than ten million people each. A single megacity, the Greater Tokyo Area, is home to more people than lived in all cities in the world just four lifetimes ago. In this century, the majority of the next generations’ children will be born and raised in cities. By 2050, the United Nations projects, population growth could add two billion people to cities. Two of every three human beings will dwell in cities.

As we became an urban-dwelling species, we made cities in the same basic modern image. Whatever a city’s age, history, or location, affluence and stage of development, economic niche or governance model, it has developed and manages massive, complex systems for buildings, transportation, energy supply, waste, water, and more. And these systems use pretty much the same technologies and processes and are professionally managed in much the same way everywhere. In all but the world’s poorest nations, 90 to 100 percent of urban populations have access to electricity. In most big cities, driving is the way to get around; between 50 and 90 percent of urban travel to and from work is done in privately owned vehicles rather than on public transit or by walking or bicycling. In China, the astonishing surge of urbanization that occurred during the past twenty years—hundreds of new cities for hundreds of millions of people—adhered to familiar elements of modern-city design: huge “superblocks” of massive energy-devouring buildings; wide streets, highways, and ring roads for cars; separated residential areas and office districts; and sprawl. These cities, explains international journalist Wade Shepard in *Ghost Cities of China*, are “centralized, ‘downtown,’ urban areas that consist of a commercial core and, often times a CBD (central business district), which are surrounded by residential areas, schools, hospitals, and green space.”

Even in Rio de Janeiro, Mexico City, and other megacities where huge populations live in informal settlements, much of the standard urban model prevails. It’s just swamped by slum dwellings

and stymied by poor transportation infrastructure, inadequate waste and sewage systems, and ineffective land use. “Rio de Janeiro is actually two very distinct cities,” explains Larry Rohter, former South American bureau chief for the *New York Times*. “Some five million people live at or near sea level in what Brazilians describe as ‘the asphalt,’ supplied with the usual public services: subways, electricity, garbage collection, and at least a semblance of the rule of law. But another million or more Cariocas, as Rio residents call themselves, have been consigned to ‘the hillside,’ a world of squatter settlements known as favelas, most of them indeed on hills, in which normal urban amenities like sewers and running water are scarce and a strikingly different system of laws, values, and conduct prevails.”

It was no accident that the development and spread of modern cities coincided with the development and spread of the Industrial Revolution and the fossil-fuel economy. Starting in Britain, cities became the places where investors in new coal-burning factories could most profitably organize and obtain the necessary mass labor and consumer markets they needed, as Andreas Malm explains in his award-winning *Fossil Capital*. As cities grew into centers of population and economic activity, they also became the locales from which as much as 70 percent of all greenhouse gases are emitted.

The urban evolution triggered by climate change is a story of coevolution: modern cities are changing the planet’s climate; the climate is changing modern cities. Cities are where the climate challenge and opportunities reside and where responses must work.

Life after Carbon unfolds in three parts.

It starts in the urban climate innovation laboratories we know. We show what makes them tick and describe the many innovations that put them at the leading edge of urban transformation. The twenty-five innovation labs we draw inspiration from—our main database—are located in fifteen different countries and six continents. They are in several different climatic zones, with about two-thirds on seacoasts. They generate varying amounts of per capita GHG emissions. They are relatively wealthy cities, in either global or national contexts.

FEATURED URBAN CLIMATE INNOVATION LABORATORIES

Austin, US	Paris, France
Berlin, Germany	Portland, US
Boston, US	Rio de Janeiro, Brazil
Boulder, US	Rotterdam, Netherlands
Cape Town, South Africa	San Francisco, US
Copenhagen, Denmark	Seattle, US
London, UK	Singapore, Republic of Singapore
Melbourne, Australia	Stockholm, Sweden
Mexico City, Mexico	Sydney, Australia
Minneapolis, US	Toronto, Canada
New York City, US	Vancouver, Canada
Oslo, Norway	Washington, DC, US

Other cities probably deserve the title of climate innovation lab. Adelaide, Auckland, Bogotá, Bristol, Buenos Aires, Curitiba, Hamburg, Helsinki, Milan, Oakland, Shenzhen, Tokyo, and Yokohama come to mind. We draw on some of their efforts in the chapters that follow but do not know them well enough to feature them more fully.

Leading innovation cities serve as key hubs in the numerous organizations and networks of urban climate innovation practitioners that have emerged worldwide in just a few decades. This is an extraordinary and unprecedented urban capacity: countless city officials, community activists, professionals, corporate leaders, scholars, and others collaborating to develop and share policies and practices that work.

In the book's second part, we closely examine four transformative ideas that are contained in lab cities' climate innovations and are replacing ideas from which the modern city model developed. We show how new ideas in the eighteenth and nineteenth century reshaped the physical, economic, environmental, and social characteristics of urban settlements, making them into the cities in which we live. We describe the similar evolutionary process that is occurring today, touched off by the innovative urban response to climate change and unleashing ideas that amount to a new model for the development of future cities.

Finally, we depict the work that lies ahead on the road to urban transformation. Cities cannot complete the journey by themselves, even as they support each other and band together. They simply don't control or strongly influence enough of the factors for success. It turns out, though, that cities are not alone in their struggle. The same transformational ideas are becoming broadly held and applied by businesses, professionals, consumers, citizens, and policymakers at other levels of government. They are emerging as a widespread way of thinking, a *gestalt*, which guides decisions in realms where cities have little control. This unmistakable trend promises to carry change beyond the world's most innovative cities and into cities everywhere.

Even as radical change gains traction in these ways, we must recognize that the work of urban climate innovation is still in an early stage of development. There is much more to do not just to spread and accelerate innovation but also to boost its effectiveness and deepen its impact. We close the story of the next global transformation of cities, the one we see all around, by surveying the landscape of crucial work ahead. This work is already under way in innovation lab cities.

The potential urban transformation we describe has decades to go before it can become the new normal for cities. Climate change is not the only driver of urban disruption and innovation, but it has several momentous characteristics. Its threat is planetary; every city must pay attention and the sooner the better. Its causes and effects are comprehensive and systemic; nearly every core urban system's performance and viability are at stake. It impacts the private, public, professional, and nonprofit sectors, as well as the individual, family, neighborhood, city, metropolitan region, state, national, and international levels.

Because of climate change, cities around the world will be different at the end of the twenty-first century. Whether they will be prosperous, healthy, safe, and better places for everyone to live remains to be seen. There's no guarantee that a climate-driven transformation will occur fully in all cities or many cities or even just a few cities. But a possible future city, a radically different city than the modern one we know, is coming into view. It is emerging in cities all around us, in the cities that have decided to turn the climate disaster into an opportunity, in cities that are making the urban future now.

*L*ife after Carbon depicts a global urban dynamic but converts financial amounts, distances, weights, temperatures, land mass, and other quantities into American-used units of measurement. As much as possible, conversion of non-US financial amounts is based on exchange rates at the time. In the case of Chinese names, we have employed the Chinese practice of putting the family name before the given name. ■

About Island Press

Since 1984, the nonprofit organization Island Press has been stimulating, shaping, and communicating ideas that are essential for solving environmental problems worldwide. With more than 1,000 titles in print and some 30 new releases each year, we are the nation's leading publisher on environmental issues. We identify innovative thinkers and emerging trends in the environmental field. We work with world-renowned experts and authors to develop cross-disciplinary solutions to environmental challenges.

Island Press designs and executes educational campaigns in conjunction with our authors to communicate their critical messages in print, in person, and online using the latest technologies, innovative programs, and the media. Our goal is to reach targeted audiences—scientists, policymakers, environmental advocates, urban planners, the media, and concerned citizens—with information that can be used to create the framework for long-term ecological health and human well-being.

Island Press gratefully acknowledges major support from The Bobolink Foundation, Caldera Foundation, The Curtis and Edith Munson Foundation, The Forrest C. and Frances H. Lattner Foundation, The JPB Foundation, The Kresge Foundation, The Summit Charitable Foundation, Inc., and many other generous organizations and individuals.

Generous support for the publication of this book was provided by Margot and John Ernst.

The opinions expressed in this book are those of the author(s) and do not necessarily reflect the views of our supporters.