1

Introduction

Setting Climate Change within the Narrative of Urban Environmental Crises and Transformation

Environmental problems have always burdened cities and their residents. This book attempts to understand how cities address environmental concerns and develop opportunities for lasting solutions. Human settlements have had to respond to a broad range of challenges associated with access to natural resource access, well-being, and quality of life (e.g., drinking water supply, exposure to pollution and environmental hazards, and congestion and mobility). History shows us that the city building and urbanization are intertwined with environmental stresses, crises, and solutions. While significant environmental problems continue to be present in cities, there is also a history of making significant advances in addressing pressing environmental challenges. What are the key lessons from these actions?

Addressing urban environmental stresses and crises requires attention, day-to-day action, and long-term planning. Many of these ongoing threats are now exacerbated by climate change. Climate change also has begun to drive a series of new and emergent environmental problems for cities such as accelerated rise of sea level and increased extreme heating. Three critical questions are: How does the current climate change threat reflect past environmental challenges? How is it different? And what can be learned from past transformative character of cities, their residents, and their leaders that might inform society today?

In response, the central objectives of this book are to critically examine how cities resolve environmental problems, what key messages from these solutions can be translated to cities of today, and how they might promote enhanced opportunities for environmental sustainability (as well as economic development and social justice). The book is centered on evaluating the underlying social–ecological–technological processes and developing an analytical framework of urban environmental change and policy and management transitions. The volume includes case study material from a variety of cities throughout the world and is presented in a series of application chapters.

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The earth is at a watershed moment for global environmental sustainability efforts. A broad consensus is now present – global climate change is underway. The earth's ecosystems and populations are facing the impacts of more frequent extreme climate events and gradual shifts in the everyday weather. Localities have begun to develop climate resilience efforts in response to these threats; however, conventional planning approaches and capacity-building strategies to tackle sustainability challenges such as increased vulnerability to extreme events have proven inadequate as the need for immediate and substantial action grows. Recent IPCC reports (IPCC 2023) indicate that greatly accelerated climate adaptation and mitigation action in the next 10 years is especially critical given the current rate of global warming.

The call has become louder for more transformative climate action that couples with sustainable economic development and social and environmental justice efforts (O'Brien 2012; Pelling et al. 2014; IPCC 2022). A climate resilient development framework (IPCC 2022) has been proposed to both serve as an outline for a transition to new kinds of broader scale adaptation and mitigation and enhance our understanding of the required transformational change. For some coastal cities, this might, for example, mean a shift from resiliency efforts that enhance the recovery from coastal storm surge flooding events to a transformative paradigm shift that includes the relocation of highly at-risk infrastructure and residential and commercial properties away from vulnerable shore locations. Conditions for meaningful and effective transformation require analysis on how significant policy and management regime shifts take place, whether there are particular moments when these types of actions are more effective and impactful, and whether there are early warning signals or conditions of such changes that can be utilized to further accelerate change.

This book directly responds to these intellectual and societal needs. It addresses this ambition by analyzing the conditions under which transitions in urban systems occur and how prospects for economically advantageous and socially just transformational change can be accelerated. The core of the analysis will be an examination of how transformational environmental action and policy change take place in cities and what lessons from this analysis can be translated into urban-focused climate adaptation and mitigation transitions and climate policymaking steps and procedures that could be coproduced by urban policymakers and practitioners (e.g., government officials) and stakeholders (e.g., nongovernmental organizations, community-based organizations, and private sector representatives).

1.1 Cities and the Climate Crisis

Human settlements and critical urban infrastructure now enduring climate change are facing more frequent flooding, droughts, heatwaves, and intense rain events as well as other climate change-related hazards (e.g., extreme wind events) (Rosenzweig et al. 2018; Dodman et al. 2022). Observed human and economic losses have increased in the past decade for urban areas and are expected to significantly increase in the future. Losses and damages from single events as well as compound, cascading, and systemic events have risen.[1]

Urban areas are now home to least 4.4 billion people, or approximately 55% of the world's population. Between 2015 and 2020, the global urban population grew by approximately 400 million people, more than 90% of this growth took place in low- and moderate-income countries. These trends are expected to continue through the next several decades. Upwards of 2.5 billion additional people are projected to live in urban areas by 2050, with up to 90% of this increase on the continents of Asia and Africa. The new population growth, coupled with the urbanization process, has brought a greater number of vulnerable and exposed urban residents and assets. Across the globe, the most rapid growth in urban vulnerability and exposure has been experienced in cities and settlements where adaptive capacity is low – particularly in informal and unplanned settlements in low- and moderate-income countries and in small- and medium-sized urban centers (Dodman et al. 2022). A key result of this is that climate impacts are experienced disproportionately in cities and urbanized areas with the most economically and socially marginalized, (Dodman et al. 2022).

Overall, the number of people expected to live in urban areas highly exposed and vulnerable to climate change impacts has increased substantially. Urban coastal locations are particularly of concern because they are often key administrative and transportation centers and suffer from multiple hazard threats including accelerated rise of sea level and related increased flooding (Pelling and Blackburn 2013; Glavovic et al. 2022).

More specifically, rise in the sea level and increases in tropical cyclone storm surge and rainfall intensity will enhance conditions for coastal city flooding. This is especially problematic given that more than a billion people

[1] Compound impacts arise from the interaction of a single climate hazard with at least one other hazard driver such as extreme heat with poor air quality. Cascade impacts are observed when damages occurring in one place or system reduce resilience or generate impacts elsewhere (e.g., when drought brings reduced hydroelectric power generation that in turn has economic consequences). Systematic impacts are associated with collapse or significant alteration of one system that has impacts on another system. The systems could be coincident or connected across space, for example, rural to urban linkages (derived from IPCC AR6, WG2 glossary).

located in low-lying cities and settlements are expected to be at risk from coastal-specific climate hazards by 2050 (Dodman et al. 2022). With respect to heat, the key drivers for increased exposure are the combination of global warming, urbanization, and the further exacerbation of local urban heat islands. Increasing urban water scarcity also is a growing challenge. Projections illustrate that 350 million people living in urban areas could be exposed to water scarcity from severe droughts at 1.5°C warming and 410.7 million at 2°C of warming (Dodman et al. 2022).

While some urban governments have been widely recognized as sites of new and innovative approaches to climate change action, most have not advanced (Rosenzweig et al. 2018; Dodman et al. 2022; New et al. 2022). Significant urban adaptation gaps exist across all different types of cities and localities. Governance capacity, financial support, and the legacy of past urban infrastructure investment now limit how cities are able to adapt (Dodman et al. 2022). Critical urban climate capacity gaps exist that hinder adaptation and mitigation.

For adaptation, these gaps include the limited ability to discern social vulnerability conditions and community strengths; the lack or minimal level of integrated planning to protect communities; and the absence or limited access to funding arrangements and minimal capability to manage finance and commercial insurance (Cutter et al. 2014; Dodman et al. 2022). For mitigation, the limitations are similar with respect to financing and technical expertise to measure and assess emissions reduction strategies. These deficits can be addressed through enhanced decision-making and action that (1) is locally accountable and utilizes local knowledge; (2) has sufficient access to the latest science, (3) is more transparent and equitable, and (4) is more focused on the rapid evaluation of these new climate solutions. Overall, it is recognized that accelerated climate change requires more responsive, flexible, and engaged action at the time when many municipal governments face constrained budgets, limited governance capacity, and increasing pressure to address significant social, economic, and environmental inequalities. A growing focus within climate change action has been to develop and implement strategies that simultaneously allow for climate adaptation, climate mitigation, and development within the context of sustainability for all. This possibility of fostering or guiding a transition that is integrative across multiple domains also is evident within the history of urban environmental transitions.

The link between climate change with urban development imperatives and demographic trends makes climate policy not only a key mechanism to safeguard development gains but also a well-defined and growing component of social struggles embedded within competing values and visions for the city

(Pelling 2010; Pelling et al. 2012; Solecki 2012; Wise et al. 2014; Garschagen and Romero-Lankao 2015; Sanderson et al. 2016). Climate risk management in the city not only affects the distribution of risk but also shapes the future of individual cities and cities collectively and the conditions faced by urban residents, leaders, and investors as well as the prospects for climate mitigation and sustainability (O'Brien 2012; Olsson et al. 2014; Pelling et al. 2014). At the same time, it has become clear that climate action is intensely local and requires people and institutions in places to make bold decisions about how to respond to climate change and to carry them out.

Cities have the potential for transformational change. Several factors are associated with this quality. These include cities' concentration of economic activity, high level of human resource capacity, dense social networks, concentration of infrastructure and building investment, relatively flexible local governments, close connection to surrounding rural and natural environments, and a tradition of innovation. Bringing financial and administrative resources from regional, national, and international sources also provides advantages for cities. Cities are increasingly seen as key potential sources of innovative solution-based policy transitions needed to address the global sustainability challenge (Dodman et al. 2022).

1.2 Environmental Stress and Crisis in Cities

Part I of the book focuses on how environmental stress and crisis are fundamental components of community development and the urbanization process. Every city present today has had to address and resolve drinking water, food, energy, and building material supply constraints during its history. The resolution of these issues is often imperfect, inequitable, unstable, and leads to unintended consequences that may cause other environmental conflicts and issues. For example, Cairo, Egypt, has water supply infrastructure that can provide water on a consistent basis to a few million people. However, the population of metropolitan Cairo is now well over 20 million. This gap must be met daily through a series of formal and informal adjustments and arrangements. Nonetheless, it is the process of addressing environmental constraints and inequities, the articulation of new policies and the transition to them that are profound elements of the city-building process that need to be better understood. These elements are examined individually and more importantly on how they link together and act synergistically, as a process of transition.

In this book, the conceptual structure of urban environmental policy transitions is developed through an integrative analytical approach that utilizes

elements from urban development theory, complex system theory, resilience theory, and urban political ecology. Transitions are multifaceted and presented as fast or slow, intentional or forced, proactive or reactive, or planned or not. They are often associated with resultant regime shifts and tipping points along with early warning signals that denote the possibility of a shift is taking place (see Wallace and Wallace 2008; Smith and Sterling 2010; Ernstson et al. 2010; Westley et al. 2011; Markard et al. 2012; Beilin et al. 2013; Lin and Petersen 2013; Bentley et al. 2014; Rocha et al. 2015; Castilla-Rho et al. 2017; Milkoreit et al. 2018 for background discussion on social–ecological transitions and tipping points).

Policy regime or paradigm shifts are coupled with significant and persistent changes in the structure and function of a system that often are recognizable only afterward (Scheffer 2009; Scheffer et al. 2012). Urban environmental management transitions involve potentially foundational changes in broader governance structures or policy objectives (Solecki et al. 2019). Multiple nested policy systems also can change form or function in a cascade of adjustments. Policy transitions will have profound impacts on the valuation and spatial and temporal distribution of potential loss and damage (Solecki et al. 2019). As a result, transitions between climate risk management policies can become a central pivot point for planning pathways to sustainable and equitable development (Wilson 2013). It is during these transitions that the possibility of considerable progress toward sustainability emerges.

To frame the analysis in the book, four steps or phases toward a policy transition are defined. They include conditions of stress, crisis, transition, and transformation. While these four phases reflect the elements of the resilience focused, adaptive cycle, here they are presented as conceptually and operationally different. Each of these phases is associated with conditions that typically serve as a precursor to the next phase. For example, during conditions of stress, resource scarcity or decline takes place, and strategic conflicts emerge as a crisis and result in demands for a solution. Significant system-wide solutions are presented as moments of transitions, and their impact, aftermath, and consequence are defined as the broader conditions of transformation. Transitions and transformations are bracketed by contestation and debate between different interest groups and coalitions. In this way, the process of urbanization and city building and environmental problem-solving takes place through tension and dialogue across formal and informal linkages and networks. The application chapters, with case studies, presented in this book highlight different aspects of these connections within coupled societal, natural, and technological systems.

In this way, the book attempts to address fundamental questions regarding the relationship between cities and the environment. Most profound and straightforward are the questions of why cities indeed want to solve environmental problems, what drives them to do so, and how and why do these actions result in winners and losers being created. Furthermore, given that urbanization is typically associated with environmental stress, why do cities want to urbanize at all. Explanation of these questions has been framed by scholars around a variety of understandings and frameworks of how human societies are organized (i.e., paradigms including neoclassical economics, anthropological and sociological theory on traditional and informal social structures, and Marxist theory). In this book, the analysis utilizes a broadly defined political ecology framework where actions and decision-making are bounded by self-interest, culturally accepted norms, and structural limits.

Answering how cities solve environmental problems must be embedded in a conversation about why do cities face continuous environmental challenges? Urbanization often is associated with multiple stresses and conflicts across a range of topics that include environmental problems. A fundamental question often addressed is how and why does environmental stress and crisis emerge with development, demand, and technology choices? And why is it often the case that solutions to these environmental problems can lead to unintended consequences including new problems, inefficiencies, and inequities?

Embedded in the objective of the book, *Cities and Environmental Change: From Crisis to Transformation*, is the question of what or who is actually acting. Given that cities literally don't or can't act, what entity has the agency to actually attempt a solution to environmental problems? Any environment-related actions taken in cities is the product of the individuals or collectives deciding, arguing, debating, and compromising about which approach to take. Part of these activities is the articulation of capacity and power to pursue specific positions and defend or assert these positions over others. Contestation is part of the decision-making process, and these processes are motivated by a series of drivers including cultural beliefs, economic position, and social status and biases.

Part I of the book also addresses why cities are important sites for environmental problem-solving and what about the character of cities helps promote such problem-solving (and the important exceptions). Answers to these questions also help explain how these conditions vary across a spectrum of different cities. The key objectives here are to define how the urbanization process results in a range of environmental stresses and crises, the overall connection between urbanization and environment using coupled human–natural

systems perspective, and how this connection emerges in different economic development contexts. One can look at each of these of questions in turn.

What makes cities places where environmental problem solving can occur, and why and when does it succeed or fail? The research literature is full of a variety of factors that are seen as contributing to environmental problem solutions emerging in cities. Cultural and social factors include the fact that cities are places where a diversity of opinions is present. Urban life requires the need for tolerance and acceptance. Diversity allows for a variety of approaches to be introduced and discussed and for solutions to be found through synthesis. Cities also are homes to social and economic elites, and often their interests and sensibilities are furthered when a city addresses its environmental problems and concerns. In pre–Civil War New York, for example, the families of the emerging wealthy merchant class were anxious to eliminate the squalor of the city's streets for reasons of health, economic, and social advancements. Internationally recognized author Charles Dickens first visited New York City in 1842 and wrote famously of its streets "reeking with dirt and filth."

Environmental problems of cities cannot be easily hidden away even when they become a part of the landscape. When they are "forgotten," they are eventually brought forward, as was done by Jacob Riis, a late nineteenth-century progressive era photographer, who illustrated how the "other half" lived in the gilded age of New York. His pictures depicted extreme poverty and unhealthy living conditions among many of the city's immigrant communities. As the problems became easier to identify, so were the potential impacts of the solutions. Environmental solutions, for example, cleaner air or streets, though challenging to attain, were often visual and tangible.

1.3 Urban Environmental Problems and Cities as Social Systems

The connection between environmental problems and a city's political and economic conditions is complex. Environmental problems often can be seen as both a product and a hindrance to further capital accumulation and effectiveness of the governing structure. In some cities, pollution became synonymous with progress and economic growth, such as steel production in early twentieth-century Pittsburgh and early instances of automobile-related pollution in Los Angeles. Since that time, chronic pollution has also become equated with decline or decay and the desire to address and mitigate the issue as a sign of progress. In this context, cities are sites that encourage solutions to environmental problems. Just as pollution is an externality from

the urban industrial process, solutions to those same externalities promote economic growth.

A classic response to urban environmental problems is the removal and relocation to nearby but relatively less populated sites. In cities of the ancient world, removal was often achieved by burying or constructing onto existing buildings and structures like the tells[2] of ancient Middle East cities. By increasing security, declining the need for a city wall, and increasing population, cities began to spread horizontally. New areas of settlement are often presented as clean and less burdened by the perceived negative aspects of urbanization but still close enough to the opportunities that urban settings possess. Conversely, these outlying areas also were frequently used as dump sites for urban refuse and waste.

In capitalist market economies, these new lands beyond the city edge often are good sites for investment and continued money-making potential, and are defined by Harvey (1985) as part of the second circuit of capital in which existing wealthy urban elite can invest and expand their fortune while expanding the city. Under these conditions it is important that distance (whether literal or figurative) between areas of poor environmental quality and better environmental quality must be maintained in order to attract investors. Investors want unspoiled land that is well-drained, accessible, and easy to build on.

Cities' experimentation and innovation have long been connected (Mumford 1961). Various informal and formal social, economic, and political drivers have been introduced to explain this phenomenon. Interpersonal connections such as conversation and experience are one set of factors that lead to re-interpretation, fusion, and synergy. Economies of scale and agglomeration also provide conditions where innovation would occur – as the entrepreneurs attempt to fill emergent gaps in the market with new products and services. The rise of interior room air filter systems is one example of industry trying to fill the gap presented by the decline in ambient air quality. With respect to governance, cities provide opportunities for gathering and meeting from which solutions to urban problems are discussed. The close geography and networking potential also present environmental problems and their implications as things that can be witnessed, lived with, and in turn addressed.

A fundamental issue in cities is who has the right of the city, who is in control, and who makes the decisions regarding how its past is understood, how the present is managed, and how the future is created. The question of and demand

[2] A mound created over centuries through the accumulation of successive layers of civilization built one over the other.

for social justice and equity is central to the everyday experience of urban residents and has emerged as a critical component of contemporary urban research and questions of urban environmental management. Critical urban social science provides a valuable lens through which to understand how the decision-making and policymaking processes take place in cities. These processes involve multiple pathways and often involve both public or overt and private or covert deliberations and debate. Urban regime theory provides insight into how in many cities, the real power to affect change and resolve crises rests in the hands of elites, sometimes coalitions of elites or sometimes a very small number of elites. Central issues are how do elites gain power and assert power in these instances, and do the decisions made under these contexts hold up over time, are they durable, and seen as legitimate. Answers to these questions often depend on the circumstances and the root (i.e., historical, cultural), context (i.e., conditions of the underlying stress and crisis), and proximate (i.e., circumstances present when the crisis becomes acute and when a transition is underway) drivers present in the case at hand. That said, broad generalizations can be defined – power to drive a transition is either granted or seized, the process of the transition is always contested, transitions will involve winners and losers, engagement will result from a mixture of choice, bounded rationality, and coercion, and it is assumed that ambition to engage in the transitions process will be pressed by self-interest or at least a specific agenda that is reflective of a particular interest.

In all policy transitions, the issues of equity, justice, and legitimation are central to overall effectiveness[3] and the impact of the transition. Decisions that are made without successfully incorporating some or all of these factors are typically not as effective. Recent research has shown that policy debates and transitions that are co-produced or co-generated with the meaningful engagement of multiple stakeholders and interest groups in a way that recognizes outcome, procedural, and representational equity are typically more effective than otherwise (New et al. 2022).

1.4 A Framework of Urban Environmental Change and Policy Transitions

With addressing the question of how cities solve environmental problems, the book's focus reveals a more specific question – what happens at the moment when the environmental policy of cities changes. Or more directly, what are

[3] The effectiveness has many definitions and perspectives, including those associated with costs and benefits, level or amount of change, acceptance, or legacy.

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the mechanisms of policy transitions in the context of a social, ecological, and technological system change? For example, what conditions might be a precondition or early warning of change, how do shifts in social systems affect ecological or technological systems and vice versa, and how do governance structures and policymaking either hinder or accelerate effective social and institutional responses to environmental threats? The structure and sequencing of these transitions will be evaluated, as will their societal and environmental implications. Social implications include those associated with economic development, sustainability, equity, and justice. Prospects for economic development have long been associated with urban environmental problem-solving and in the past two decades conditions of sustainability, equity, and justice have been added to the configuration. Because they are historical in nature, the book's application case studies, highlighted in Part II of the volume, often do not directly speak to these three more recent elements; however, aspects of how they do are highlighted as are how they might be relevant to contemporary climate change issues that will be presented.

Environmental implications involve shifts in natural capital and ecosystem services. In both instances, the policy implications and feedback can be a significant part of the transition aftermath. An important part of the narrative will be an analysis of how to predict or understand when a city is going through a policy transition and whether there are early warning signals or indicators of a transition. The book helps to scaffold and define the components of the framework and their interaction and operational issues. Chapters 2 through 4 present the background literature to be utilized in the book. At the end of Chapter 4, a framework to understand urban environmental policy transitions is presented.

The subsequent application chapters utilize the framework and provide empirical evidence for its potential adjustment and elaboration. The discussion examines these issues within several contexts, each one defining a different group of conditions presented within case studies across several domains. These include natural resource supply and scarcity, environmental degradation and quality, resource use efficiency including solid water management, disease and epidemics, environmental risks and hazards, and mobility and settlement. Each chapter includes a set of case studies that helps elucidate part of the internal mechanism of the framework.

Natural resource supply and scarcity is the most fundamental environmental question facing cities. The everyday life of cities can only be sustained with continuous access to water, food, energy, and other raw materials for shelter and other aspects of the built environment. Chapter 5 examines drinking water supply stress, crisis, and policy transition across a group of cases

focused on Atlanta, US; Cairo, Egypt; New York City, US; and Tel Aviv, Israel. The objective of the studies focuses on how urban drinking water supply provision is a story of recurring catastrophic failure and impressive success and associated policy experimentation and transition.

Environmental degradation and quality represent another critical area of social and environmental change in cities. A result of urbanization is a local decline in environmental conditions and ecological function. These conditions include changes in water and air quality, solid waste, and land degradation. The case studies presented in Chapter 6 focus on urban air quality stress, crisis, and policy transition, including energy production switching. Examples of urban air pollution control include London, UK; Los Angeles, US; the Ruhr River Valley, Germany; and Tokyo, Japan, and present an evaluation of transboundary pollution and metropolitan-scale environmental problems.

Acute disease spread, epidemics, and pandemics have been a significant component of urban history. The COVID-19 pandemic has been only the most recent example since the initial outbreak in the early months of 2020. The virus spread rapidly around the world initially impacting global urban transportation hubs and then other urban areas generally especially hard. Cities have experienced and responded to past disease outbreaks that ravaged the health of residents and caused significant political and economic impact. Cities have reacted to these crises in a variety of ways and episodes have at times forced a rethinking of city form and function, and other transformative adjustments. The four narrative examples examined in Chapter 7 focus on how cities have attempted to solve these threats both within the moment of the outbreak and during the longer-term recovery. The examples include Marseille, France; Hong Kong, China; St. Louis, US; and Seoul, South Korea.

Cities are subject to environmental risks and hazards, both natural and technological. These events both as low-frequency/high-consequence and chronic events have played a significant role in the identity and structure of cities. Environmental risks and hazards result in a variety of stresses to cities and their residents that can result in crises and potential policy changes. These policy transitions can result in fundamental new types of human–environment interactions and patterns of resource use. Chronic risks, such as intense heat as well as catastrophic events such as a major hurricane/typhoon, steadily shape how communities manage and perceive their local environment. Understanding of how cities have been able to attend to and effectively respond to these events becomes a key exemplar of how other cities might be able to respond to current and future climate change. Case studies of urban risk management are presented in Chapter 8 to examine these issues. The set includes the cities of

Abu Dhabi, United Arab Emirates; Kolkata, India; New Orleans and Cedar Rapids, US; and Rotterdam, the Netherlands.

The drive to environmental sustainability in cities reflects attempts by cities to address resource use conditions and becomes the focus of the final two application chapters (Chapters 9 and 10). The capacity to respond to shocks is a key component of environmental sustainability. Equally fundamental are pathways to promote resource use efficiency such as the long-term use of the three Rs (reduce, reuse, recycle) and insights into slowly evolving crises and related policy transitions. These actions are critical for promoting the triple bottom line of simultaneous environmental, economic, and equity advance. The four cases that examine these questions are focused on Buenos Aires, Argentina; Johannesburg, South Africa; Seattle, US, and Taipei, Taiwan. These studies present the integration of environmental sustainability concepts into everyday practice within municipal government, businesses, and households.

A great challenge of urban development and city building is providing opportunities and conditions such that residents can live in a home within a clean and healthy environment and allowing them to move about the city in a way to promote economic advancement and equitable well-being. Achieving these factors requires cities to integrate conditions for urban sustainability, including social and environmental equity, economic development, and ecosystem integrity. This chapter is focused on examining how cities have dealt (or not) with this simultaneity of stresses and crises and the extent to which solutions presented have led to significant transitions and transformations. The chapter includes an examination of four cities that have struggled with these challenges and to one degree or another have addressed. These cities highlight this process of integrating livability and sustainability with the context of equity, economics, and ecology. The cities highlighted are Miami, US; Oslo, Norway; St. Georges, Grenada; and Shenzhen, China.

The results of the application chapters are reviewed and synthesized in Chapter 11. Several different perspectives are evaluated and considered, including character and structure of the crises, shifts in system resilience, and transition conditions. Comparisons are made across the application chapters and 25 case studies and within and between each crisis topic (i.e., water shortage, air pollution). This analysis serves as the foundation for the concluding chapter (Chapter 12), which is focused on translating these results and findings into specific conclusions and recommendations that are specifically relevant to urban-based stakeholders focused on advancing, if not accelerating, climate action in their city.

1.4.1 How the Book Can Contribute

In the past decade, significant research within geography and allied disciplines such as sociology, anthropology, economics, political science, and urban studies among others has been conducted that attempts to understand how urban social–ecological–technical systems (e.g., interconnected sets of systems) are organized, function, and respond to environmental stresses and crises and transition to solutions. The capacity of these systems to respond to stress is driven by the nature of the stresses and the structure and resiliency (i.e., ability to respond to shocks or other limitations) of the systems. The book directly addresses these issues through the development of a framework for urban climate policy transition analysis. The application chapters helps define pathways for testing the validity and robustness of the framework in a flexible adaptation context.

The history of how cities have responded to environmental problems (or not) has implications for an urban climate change transition theory and transformative climate adaptation and mitigation. The analysis also will bring forward findings that have relevance for stakeholders and practitioners, businesses and industries, and community-based organizations across a spectrum of cities and metropolitan regions of the Global South and North, which vary in vulnerability/resiliency, governance capacity, and human and financial resources, and the conditions of economic development. The results are directly germane to the ambition of the UN-driven climate-resilient development pathways and the related 17 sustainable development goals (SGDs) of the United Nations 2030 Agenda for Sustainable Development. The final chapter of the book will focus on defining how components of the framework, as an analytical tool, can be more concretely applied to understanding how cities are now and could potentially in the future respond to climate change. This discussion will present policy-relevant recommendations.

The book's analysis framework, application chapters, and case studies illustrate how the opportunities for transitions to transformative climate action can be enhanced for use by local policymakers and practitioners. Highlighted are specific tools and strategies, financing and governance, and knowledge coproduction, and the role of boundary organizations. Underlying the analysis is how the framework can be applied in cities to promote transformative change. Explicit is the understanding that the framework can be used as a normative tool for enhanced climate action.