



Critical Introductions to Urbanism and the City

Harriet Bulkeley

Cities and Climate Change

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Climate change is one of the most significant global challenges facing the world today. It is also a critical issue for the world's cities. Now home to over half the world's population, urban areas are significant sources of greenhouse-gas emissions and are vulnerable to the impacts of climate change.

Responding to climate change is a profound challenge. A variety of actors are involved in urban climate governance, with municipal governments, international organizations and funding bodies pointing to cities as key arenas for response. This book provides the first critical introduction to these challenges, giving an overview of the science and policy of climate change at the global level and the emergence of climate change as an urban policy issue. It considers the challenges of governing climate change in the city in the context of the changing nature of urban politics, economics, society and infrastructures. It looks at how responses for mitigation and adaptation have emerged within the city, and the implications of climate change for social and environmental justice.

Drawing on examples from cities in the north and south, and richly illustrated with detailed case studies, this book will enable students to understand the potential and limits of addressing climate change at the urban level and to explore the consequences for our future cities. It will be essential reading for undergraduate students across the disciplines of geography, politics, sociology, urban studies, planning, and science and technology studies.

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Routledge critical introductions to urbanism and the city

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1 Climate change – an urban problem?

Introducing climate change

Over the past two decades, the term ‘climate change’ has for many acquired a well-worn familiarity. Whether on the pages of the national newspapers, through events such as the NDTV–Toyota’s Greenathon in India, the WWF Earth Hour campaign, or the commitments of an ever-growing number of businesses to address the issue, climate change has entered into the popular vocabulary (Hulme 2009). Yet, at the same time, climate change remains a distant concern. In many parts of the world, and for many people, the extent and consequences of the ways in which human activities may be leading to long-term changes in the global atmosphere are obscured. This may be because of continued scientific controversy and political attempts to deny the significance or importance of the issue, or it may be because other, pressing, concerns dominate daily life. Elsewhere, climate change has a distant presence; it is an issue that rumbles on in the background to daily lives, surfacing at particular moments as, for example, international leaders seek agreement at the latest negotiations or another climate-related disaster strikes.

These qualities have made climate change one of the most taken-for-granted and most debated issues of the contemporary era. Although most agree that it is a serious issue that requires sustained attention and action, over two decades of international negotiation have yet to deliver a significant global response. The longevity of these debates, and the lack of resolution at the international level, could lead many to dismiss climate change as a lost cause. Given this context, it is worth reminding ourselves just what might be at stake. In their 2007 Fourth Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) found that the weight of scientific evidence indicated that, ‘warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level’, and

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that this was beginning to have an effect regionally on natural systems (IPCC 2007a). The IPCC found that, over the period from 1970 to 2004, there had been a 70 per cent increase in global emissions of greenhouse gases (GHGs) (Box 1.1) and concluded that, ‘most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations’ (IPCC 2007c). As a result of changing climatic conditions, the IPCC identified a series of potential impacts on different human and natural systems in different regions of the world, illustrated in Table 1.1.

Although the IPCC’s language and its cautious calculation of the potential for global warming and the ensuing impacts have become an accepted part of society’s understanding of climate change, for others it is precisely this language that has served to diminish society’s engagement with the potentially far-reaching implications of a changing climate. From this perspective, what John Urry has termed the ‘new catastrophism’, climate change, is regarded as a symptom of the failures of industrial society, and, as such, ‘there are no guarantees that the increasing prosperity, wealth, movement and connectivity of the industrial period will continue forever. A new and darker epoch may

BOX 1.1

What are GHG emissions?

Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth’s surface, the atmosphere and clouds. This property causes the greenhouse effect. Water vapour (H₂O), carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄) and ozone (O₃) are the primary GHGs in the Earth’s atmosphere. Moreover, there are a number of entirely human-made GHGs in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances, dealt with under the Montreal Protocol. Besides carbon dioxide, nitrous oxide and methane, the Kyoto Protocol deals with the GHGs sulphur hexafluoride, hydrofluorocarbons and perfluorocarbons.

(IPCC 2007b)

Table 1.1 Predicted regional impacts of climate change

<i>Region</i>	<i>Potential impacts of climate change</i>
Africa	By 2020, between 75 and 250 million people may be exposed to increased water stress. Towards the end of the 21st century, projected sea-level rise will affect low-lying coastal areas with large populations.
Asia	By the 2050s, fresh-water availability, particularly in large river basins, is predicted to decrease. Coastal areas, especially heavily populated mega-delta regions, will be at risk from increased flooding. Climate change is projected to compound the pressures on natural resources associated with rapid urbanization and economic development.
Australia and New Zealand	By 2020, significant loss of biodiversity is projected to occur, including in the Great Barrier Reef and Queensland Wet Tropics. By 2030, water-security problems are projected to intensify in southern and eastern Australia. Coastal development and population growth will exacerbate risks from sea-level rise, storms and coastal flooding by 2050.
Europe	In southern Europe, climate change is projected to exacerbate high temperatures and drought, and reduce water availability. Climate change is also projected to increase the number of heatwaves and the frequency of wildfires.
Latin America	There is a risk of significant biodiversity loss through species extinction in many areas of tropical Latin America. Changes in precipitation patterns and the disappearance of glaciers are projected to significantly affect water availability.
North America	Warming in western mountains is projected to exacerbate competition for over-allocated water resources. Urban heatwaves are expected to increase in number, intensity and duration, with potential for adverse health impacts. Coastal communities and habitats will be increasingly stressed by climate-change impacts interacting with development and pollution.

Source: Adapted from IPCC 2007c

lie in the quite near future' (Urry 2011: 36). Critical thinkers such as Bill McKibben, James Lovelock and Mark Lynas have argued that the increased levels of GHG emissions in the atmosphere are likely to lead to a range of significant and catastrophic effects that would disrupt global markets, create flows of climate refugees, and challenge existing forms of political order (McKibben 2011; Lovelock 2009; Lynas 2004). In this sense, climate change

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is not a problem that can be managed through the application of new scientific knowledge and policy instruments, but rather requires fundamental shifts in the ways in which economies and societies are organized and operate.

Although they differ considerably in how the challenge of climate change is understood, both the ‘scientific-managerialist’ and ‘new-catastrophist’ views tend to assume that the issue is one of global proportions, with complex scientific and political dimensions. In this context, to consider climate change as an *urban* problem may seem counter-intuitive. As a matter of GHG emissions, atmospheric conditions, global disruption, extreme events, international negotiations, rapidly increasing populations and national economies, climate change may at first glance appear to have little to do with the city. However, as the rest of this book sets out in detail, it is increasingly recognized that cities are not merely a backdrop against which these global processes unfold, but are central to the ways in which the vulnerabilities and risks of climate change are produced, and to the possibilities and challenges of responding to these issues. Understanding the urban nature of climate change requires that we examine, not only the ways in which the issue is being produced, reconfigured and contested within cities, but also how climate change has come to feature in the imagination and creation of urban futures.

The rest of this introductory chapter is divided into three sections. The first considers in more detail how and why we might view the global challenge of climate change in relation to the city. In the second section, the ways in which our visions of the implications of climate change and of urban futures shape our response to these issues are explored. As is clear from the discussion above, thinking about climate change evokes some image of, and relation to, the future. More or less implicitly, cities loom large in the scientific, political and cultural imagination of a climate-changed world. Thinking through the diversity of urban climate-change futures that emerge in this manner is instructive in terms of understanding how the city is regarded as both the cause of, and solution to, the climate crisis. Moving beyond these utopian and dystopian caricatures, however, requires a considered and detailed examination of just how and why climate change comes to matter in the city. The third part of the chapter outlines the rest of the book and the ways in which it seeks to address this challenge.

Before turning to these matters, a few issues of terminology are worth considering. Throughout the book, the terms ‘urban’, ‘city’ and ‘cities’ are used interchangeably. Broadly speaking, ‘city’ is usually used to refer to a specific place or locale that has urban characteristics (e.g. of density of population, social/economic activities, forms of public culture), but, beyond the

political jurisdiction of urban local authorities (here termed municipalities), its boundaries are difficult to define. It is also vitally important to recognize the significant differences in the ways in which cities are encountered and experienced by different social groups and individuals – such as women, children, the economically affluent and mobile, or those who are economically and socially disadvantaged. Using the term ‘urban’ or ‘city’ can too readily mask those differences, although in an introductory book of this nature the use of such shorthand terms is inevitable. Throughout the book, the intention is to explore and examine how the multiple dimensions of climate change are experienced differently within and between cities, and to consider the implications for issues of social and environmental justice.

What has climate change got to do with the city?

It was in the early 1980s that the issue of climate change began to feature prominently on scientific and political agendas. Although early scientific investigations had shown that particular gases, when present in the atmosphere, could have a warming effect on the atmosphere by trapping incoming solar radiation, it was not until the 1980s that the potential implications of this physical phenomenon began to be realized by the international political community (Paterson 1996). Following a series of scientific meetings and political summits, in 1992 the landmark international agreement to address climate change, the *United Nations Framework Convention on Climate Change* (UNFCCC) was agreed. At the heart of the UNFCCC is the intention to stabilize GHGs in the atmosphere at a level that would ‘prevent dangerous anthropogenic (human induced) interference with the climate system’, while recognizing the need to adapt to the potential effects of climate change (UNFCCC 1992). Throughout this process, climate change was regarded as a problem of common property – although individual nation-states might be contributing to the problem, through their GHG emissions, the effects would be felt by all countries, and particularly in the least developed economies, who had not contributed significantly to the problem.

Resolving climate change, therefore, required an approach that could foster collective action for reducing GHG emissions while recognizing the different responsibilities of economically developed and less economically developed countries. Seen in this way, attention focused on how to achieve an international agreement that would bind nation-states to ‘common but differentiated’ targets and timetables (UNFCCC 1992), and, in 1997 the Kyoto Protocol was established as a means towards this end. The Kyoto Protocol committed thirty-eight industrialized countries to reduce GHG emissions by

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an average of 5.2 per cent below 1990 levels during the period 2008–12, and established a set of flexible mechanisms through which individual national targets could be reached. These included the provisions for establishing carbon trading between economically developed countries and the Clean Development Mechanism (CDM), through which economically developed countries could undertake projects to reduce GHG emissions in less economically developed countries as part of reaching their national targets. Since Kyoto, negotiations have continued over just how these provisions should be implemented and have grown in complexity as the climate-change agenda has grown to include different areas of activity – notably, how we should adapt to the effects of climate change, and how we might reduce the impact of deforestation on the atmosphere. These negotiations have also reflected the changing position of different nation-states over the past two decades, including the reluctance of the US to participate in an international agreement and the recognition that major industrializing economies, such as Brazil, India, China and Mexico, should have a role to play in meeting international targets for reducing GHG emissions. In 2009, the international community, global media, non-governmental organizations and many businesses with interests in responding to climate change gathered in Copenhagen for one set of negotiations, believing that a breakthrough in the impasse might be possible. The tangible disappointment that followed the apparent failure of these talks is a sign of just how much has come to depend on addressing climate change, and the extent to which it is considered as a *global* problem requiring *global* solutions (Bulkeley and Newell 2010).

There are, however, other ways of viewing the climate problem and the ways in which it could be addressed. If we step back from the idea of the global commons of the atmosphere and consider instead how, why and where GHG emissions are produced and the risks of climate change may be felt, a different set of processes, actors and possibilities comes to mind. The GHG emissions that are contributing to the condition of climate change do not arise from some uniform and invisible source, but, rather, are the product of the ways in which energy is used in our homes and cars, is used to make the things we consume and the goods we use, as well as through our management of the land and forests. It is these processes, taking place in a highly uneven manner across different national contexts, that create both current atmospheric conditions and the common but differentiated responsibilities for acting on climate change. At the same time, the impacts of climate change are not spread evenly, but rather occur in particular locations – such as those prone to flooding or drought – and affect different groups of society in radically different ways, depending on their capacity to cope with, and adapt to, risks. These ways in

which climate change is closely intertwined with political economic structures and our daily lives is one of the reasons why it has proven so difficult an issue to address internationally. However, it also demonstrates that we can think about climate change differently – not as a *global* issue in the sense that it occurs in the same way across the world, but as one that has very different histories and geographies, varying across time and space and in its implications for economies and societies.

It is in this view of climate change, as shaped by diverse processes that vary not only between different nation-states but also within and across national boundaries, that the city comes into view (Table 1.2). Although the definition, nature and character of ‘the city’ as any singular entity are highly variable and contested, it can be shown that the twentieth century witnessed a rapid process of urbanization, particularly in the industrialized countries of Europe, North America and Australasia, and more recently in Asia, so that, by 2010, over half of the world’s population lived within some form of urban context that is broadly understood as a ‘city’. By 2030, it is predicted that almost 5 billion of the world’s population of over 8 billion will live in cities, and this process of urbanization is likely to be most rapid in the least developed countries. Although large megacities will continue to grow rapidly, most urbanization is predicted to take place in smaller urban centres (UN-Habitat 2011: 2). As sites of rapidly growing population, cities have come to be seen as part of the climate-change problem. On the one hand, cities are now seen as potential sites of climate vulnerability. Because of the history of economic development, cities can occupy locations that are regarded as particularly vulnerable to climate change. The 2006 Stern Review, carried out for the UK government, finds, for example, that:

Many of the world’s major cities (22 of the top 50) are at risk of flooding from coastal surges, including Tokyo, Shanghai, Hong Kong, Mumbai, Calcutta, Karachi, Buenos Aires, St Petersburg, New York, Miami and London.

Stern 2006: 76

At the same time, the rapid pace of urbanization is serving to produce its own forms of vulnerability within the city, as ‘people arriving in already overstressed urban centres are forced to live in dangerous areas . . . many constructing their own homes in informal settlements on floodplains, in swamp areas and on unstable hillsides’, in areas that lack necessary infrastructures and basic services (UN-Habitat 2011: 1).

On the other hand, cities are regarded as critical to the production of the GHG emissions that are creating the risks of climate change in the first place

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Table 1.2 Cities and climate change: part of the problem, part of the solution?

<i>Cities as part of the climate problem?</i>	<i>Cities as part of the climate solution?</i>
In 2010, more than half of the world's population lived in cities	Municipal authorities have responsibility for many processes that shape urban vulnerability and affect GHG emissions at the local level
By 2030, almost 5 billion of the world's 8.3 billion people will live in cities	Municipalities have a democratic mandate from local populations to address issues that affect the city
Cities have historically developed in locations that may be vulnerable to change, including in coastal areas and on rivers	Municipalities have a history of addressing issues of sustainable climate development
Rapid urbanization is creating significant urban challenges that will be exacerbated by climate change	Municipalities can act as a 'laboratory' for testing innovative approaches
Cities represent concentrations of economic and social activities that produce GHG emissions	Municipal authorities can act in partnership with private and civil-society sectors
Cities and towns produce over 70% of global energy-related CO ₂ emissions	Cities represent high concentrations of private-sector actors with growing commitment to act on climate change
By 2030, over 80% of the increase in global annual energy demand above 2006 levels will come from cities in non-OECD countries	Cities provide arenas within which civil society is mobilizing to address climate change

Source: Adapted from UN-Habitat 2011: 91

(Bulkeley and Betsill 2003; UN-Habitat 2011: 91). The concentration of energy use within urban areas, in industry, transportation, and domestic and commercial buildings, means that cities are central to the ways in which GHG emissions, and particularly carbon dioxide, the most common GHG, are produced. The International Energy Agency (IEA) (2009: 21) has found that cities and towns currently consume over two-thirds of annual energy demand and 'produce over 70 per cent of global energy-related carbon dioxide emissions'. By 2030, their predictions are that, with 60 per cent of the world's population, cities and towns will consume over three-quarters of the world's energy demand, and that, 'over 80 per cent of the projected increase in demand above 2006 levels will come from cities in non-OECD countries' (International Energy Agency 2009: 21); that is, the vast majority of future increases in energy demand will come from those least developed and

developing countries outside the Organisation for Economic Co-operation and Development (OECD).

As a result of the growing urban population and energy demand, cities are therefore seen as both the victim and culprit of climate change. Against this rather bleak picture, however, other views of the city as part of the *solution* to climate change are also emerging (Table 1.2; see also Bulkeley and Betsill 2003; UN-Habitat 2011: 91). Realizing the connection between climate change and existing forms of urban vulnerability, the nature of urban development and the daily use of energy requires recognition of the role that urban authorities – termed municipalities or municipal authorities in this book – have in shaping these processes. Municipalities have significant, although highly varied, roles in relation to urban planning, building codes, the provision of transportation and the supply of energy, water and waste services that shape existing patterns of vulnerability and the production of GHG emissions. Given these powers, and their democratic mandate as the local level of government, municipalities can therefore be seen as in a position to address the challenges of mitigating and adapting to climate change. Cities have a history of engaging with issues of sustainable development and can be centres for innovation, with the capacity to test new technologies and approaches, offering a means through which novel responses to climate change could be generated. Increasingly, cities are also home to a number of private and civil-society actors who are seeking to address climate change. In some cases, such actors are developing independent responses to climate-change mitigation and adaptation, but elsewhere municipalities can provide the basis for establishing partnerships with this diverse range of actors to approach these issues. It was this view, of cities acting on their ability to intervene in critical policy areas, democratic mandate, experience with sustainability planning and innovation, as well as their partnerships with other relevant actors, that led the mayors of some of the world's largest cities to call attention at Copenhagen to the importance of urban responses to climate change:

We, the mayors and governors of the world's leading cities . . . ask you to recognise that the future of our globe will be won or lost in the cities of the world.

(Copenhagen Climate Communiqué, December 2009)

Urban worlds and climate-change futures

For the group of the world's urban political leaders gathered at the 2009 Climate Summit for Mayors, taking place alongside the international Copenhagen climate talks, cities represented a battleground for our collective

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global futures. At stake, it seems, are competing views of what the city is and what it might become. As climate change has become a matter for popular culture and has entered into different forms of political, social and artistic consciousness, so too has the matter of urban futures become tied to our visions of what the climate problem is and how we might respond.

One such set of discourses has focused on the potential for climate change to cause catastrophe and the collapse of existing forms of civilization. The city takes central stage in these visions. In the 2004 film *The Day After Tomorrow*, rapid and abrupt climate change wreaks global havoc, with climate-related disasters striking Los Angeles, New Dehli and Tokyo and, centrally for the film's plot, flooding New York. In *Postcards from the Future*, an exhibition held at the Museum of London from October 2010 to March 2011, artists Robert Graves and Didier Madoc-Jones illustrated multiple forms of climate future for London, showing the fragility of the city in relation to the impacts of sea-level rise, abrupt glaciation, drought and climate migration. Beyond these images of the city as the somewhat unwitting victim of a climate-changed world are other urban dystopias in which the culpability of cities for climate change is writ large. Here, discourses and images of the city echo the official statistics of ever-growing urban populations and energy demand articulated by the United Nations and IEA, but the city is transformed from an abstract set of calculations to be seen as a site of insatiable consumption, greed and desire. In the 2010 novel by Ian McEwan, *Solar*, the central character describes his ambivalence on viewing the city from the air:

Whenever he came in over a big city he felt the same unease and fascination. The giant concrete wounds dressed with steel, these catheters of ceaseless traffic filing to and from the horizon – the remains of the natural world could only shrink before them. The pressure of numbers, the abundance of inventions, the blind forces of desires and needs looked unstoppable and were generating a heat, a modern kind of heat that had become, by clever shifts, his subject, his profession. The hot breath of civilisation. He felt it, everyone was feeling it, on the neck, in the face.

(McEwan 2010: 109)

In their discussion of the opportunities for, and limits to, urban responses to renewable energy, the IEA tells a 'Tale of two cities' (International Energy Agency 2009: 27–37). One, 'Bleak House', in which the impacts of climate change combine with urban dysfunction, including energy shortages, urban congestion, limited supplies of potable water, to create a bleak view of urban futures, a dystopia of urban neglect and decay. A second, 'Great expectations',

represents a vision of ‘the transition to a new, decentralised, decarbonised energy world: “it was the best of times”’ (International Energy Agency 2009: 31), in which a range of new technologies that offer low-carbon energy are integrated into a new urban Utopia of a clean, vibrant and connected set of communities. This vision of a high-tech, low-carbon Utopia is increasingly associated with cities: a vision of plenty, continued economic prosperity and access to affordable energy for all. This is a view in which the individual elements of the city need to be brought together in a planned, coherent manner in order to respond to climate change. For Arup, an urban-development company, the challenge of climate change requires a holistic, integrated view of the city: ‘creating a resilient city requires technical understanding of many individual elements, as well as the policy and regulatory frameworks that integrate them. Arup is well placed to help with it all’ (Arup 2011a). In this vision, urban systems are able to be marshalled in response to climate change, creating a systemic and integrated response to challenges of both adaptation and mitigation. Such technical, often managerial, Utopias are of course not new in the urban arena – from ideas of the Garden City to Le Corbusier’s visions of modernist urban planning, the urban has been an arena in which such ideals have been configured and contested. They rely on a particular sense of the urban as a system that can be known and is amenable to intervention. In other words, viewing urban responses to climate change in this manner involves a preconception of the urban as a relatively organized system, in which interventions can be readily planned and implemented. Various organizations, from IBM to Greenpeace, energy companies to governments, have started to create platforms and interfaces through which these discourses can be put to work to test new forms of urban future (Box 1.2).

Other utopian visions of the urban response to climate change are somewhat different. They are based on the idea of the urban as a place in which responses are emergent, coming from the activities and self-organization of independent actors, and where there are radical possibilities for living different urban lives in reconfigured urban economies. Less well established in mainstream discourses, this is a vision that might be termed ‘decentralised engagement’ (Foresight 2008: 117), in which multiple actors seek to develop measures that provide low-carbon energy and transport, or address urban vulnerability and foster resilience ‘from the bottom up’. For some, this is a story of ‘disruptive forms of innovation – cheaper, easier-to-use alternatives to existing products or services often produced by non-traditional players that target previously ignored customers’ (Willis *et al.* 2007: 4). In terms of supporting adaptation, this is often a form of response focused on communities and recognizing that, ‘planning and intervention design should use people’s

BOX 1.2

**Virtual urban responses to climate change:
LogiCity**

LogiCity is a fun interactive computer game with a difference. Aimed at young people under 25, it's a game set in a 3D virtual city with five main activities where players are set the task of reducing the carbon footprint of an average resident. As players work their way through the game they will pick up information about Climate Change and some of the main ways in which everyone is currently contributing to the emissions of the main greenhouse gas (CO₂) that causes Climate Change.

It places individuals in a virtual environment and lets them experiment and experience the potential effect that individual actions can have on the planet before it's too late. Users can travel to the future to see the direct results of their actions in real time by quickly fast forwarding to the year 2066.

The game is part of Defra's Climate Challenge programme to increase public awareness of Climate Change across the country. The National Energy Foundation, Logicom and British Gas are also providing some support to the game's development.

(LogiCity 2012)

own ability and practice of experimentation and innovation as an entry point', while also working to overcome existing institutional and political constraints (Levine *et al.* 2011: ix). For others, the vision is of a more radical disconnect from existing norms of growth, consumption and urbanization, where, for example, new forms of food and energy provision are located in cities and managed through different kinds of collective action. While the Transition Towns movement (as discussed further in Chapter 7) is mobilized around the notion of community, this is increasingly being taken up in towns and cities:

Transition Initiatives, community by community, are actively and cooperatively creating happier, fairer and stronger communities, places that

work for the people living in them and are far better suited to dealing with the shocks that'll accompany our economic and energy challenges and a climate in chaos.

(Transition Town Network 2012)

Although these different utopian views of urban responses to climate change differ significantly in how they view the role of technology, economy, government and community, they share a sense of the city as a space of possibility, potentially in the face of more far-reaching systemic change and collapse, and of the ways in which responding to climate change is not only a matter of addressing a seemingly global environmental challenge but also of reconfiguring urban systems and daily experiences.

More or less implicitly then, the city has come to figure in our political, economic and cultural imagination of climate change (Figure 1.1). Discourses of climate dystopias either play out across an urban landscape or place the city as central to unfolding catastrophe. The city is regarded as either the victim of the dangers emergent in the complexity of climate change, or as the culprit of the organized irresponsibility through which dangerous climate change is being produced. Utopian visions of the social and technical response to climate change are also conducted through different imaginations of the future city. One set of stories reveals different kinds of climate-controlled

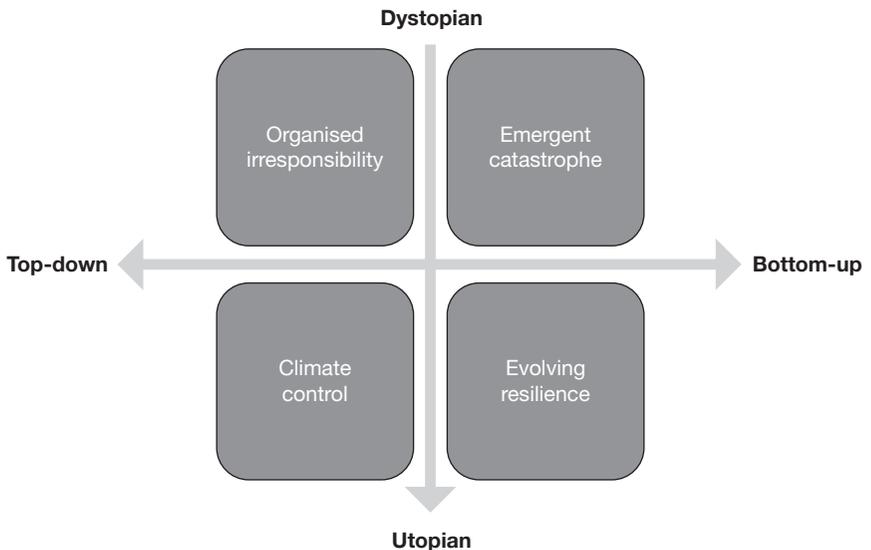


Figure 1.1 Imagining urban climate-change futures

future, achieved primarily through combinations of managed change and technical innovation. Another discourse shows the urban landscape as more emergent and fragmented, where the complexity of climate change leads, not to catastrophe, but rather to evolving forms of innovation and grass-roots alternatives with radical potential.

Chapter outline

Cities are now firmly on the climate-change agenda. The ways in which the effects of climate change are produced through and by cities and the manner in which our understanding of the urban is being challenged and reshaped by climate change are the subject of the rest of this book. Throughout the book, examples from different cities and communities are used to illustrate and explore the issues and arguments raised. Given the scope and range of material covered, readers are encouraged to use the references and suggestions for further reading to explore individual cases in more depth. This is also a fast-moving field, including many more valuable studies and examples than are referred to only in these pages.

In Chapter 2, we consider the issue of the *impacts* of climate change and the challenge of *vulnerability* in more detail. The chapter examines the challenges of creating accurate and useful information about how climate change might affect cities, and how and why we might come to understand urban vulnerability in relation to climate change. An in-depth case study of the issue of climate-change vulnerability in Cape Town illustrates these issues. Chapter 3 assesses how we can account for urban GHG emissions and the common but differentiated *responsibilities* for producing climate change that are emerging at the urban level. Some of the challenges of creating reliable and accurate models of urban GHG emissions relate to technical matters, but others concern just how we should draw the boundaries around cities and their wider connections to the processes of economic production and consumption. As the case study of Amman shows, these are important issues, particularly as cities seek to gain international financial support for taking action on climate change.

In Chapter 4, we turn to exploring how we might understand urban responses to climate change. It focuses on those urban responses that can be described as *governing*: that is, those that can be regarded as involving some degree of intervention in order to direct or guide the actions of others. The chapter outlines the multilevel context within which the history of urban climate-change governance has evolved, the different modes of governance that have

been deployed, and the drivers and barriers that have shaped urban responses to date. The case of Melbourne is used to illustrate these processes in depth.

While the realities of many urban contexts mean that it is difficult to separate climate-change mitigation from adaptation, international convention, national policy and financial support for responses to climate change maintain this divide. At the level of the city, to date, significant differences can also be identified in the histories of mitigation and adaptation response, and in terms of the actors involved and initiatives that are being undertaken. Chapter 5 focuses on *climate mitigation and low-carbon cities*, first setting out the core terms and issues, before detailing how urban mitigation policy has developed, examining the evidence of how mitigation is taking place in practice, and considering the drivers and barriers shaping mitigation responses. Using the case of São Paulo, the ways in which this process of addressing mitigation takes place are examined in further depth. In Chapter 6, the issue of *adaptation* is addressed through a discussion of definitions and key debates in the field, analysis of the emergence of adaptation policy, and an examination of the practice of adaptation at the urban level and the drivers and barriers that have been critical in shaping this response. The case study of Philadelphia shows how adaptation policy and measures have only recently emerged on urban agendas and illustrates the challenging issues of vulnerability that they are seeking to overcome.

Whereas Chapters 5 and 6 place municipalities at centre stage, focusing on formal processes of policy-making and the sorts of intervention and measure that municipal authorities have undertaken, Chapter 7 starts from a different basis and examines the *experiments and alternatives* that are emerging as part of the urban response to climate change across a wide range of state and non-state actors. Despite significant challenges facing the development and implementation of urban climate-change policy, there is evidence of an increasing number of projects and initiatives taking place in cities that are apparently concerned with climate change. The chapter explores the reasons for this growth of ‘climate-change experiments’ and how we might understand their role in urban climate-change responses and considers four different types of experiment – as policy innovation, eco-city development, technological innovation, and the transformation of everyday practices. At the same time, different forms of climate-change response, concerned with issues of social justice, with resilience and with radical alternatives, can also be found taking place in cities. The chapter examines why and how such alternatives are emerging, and what their implications might be for how we think about climate change and the city. Chapter 8, in conclusion, summarizes the main topics and debates discussed in the book and considers their implications for issues

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of social and environmental justice, as well as the future of urban responses to climate change.

Discussion points

- Why and how can climate change be thought of as an urban problem?
- For one or more work of climate-change fiction – book, film, poem or exhibition, for example – analyse the ways in which the relationship between climate change and the city is articulated. Working in small groups or a class, compare and contrast the differences between different texts and discuss how these might be explained.
- Taking the example of a city with which you are familiar – your home town, somewhere you have visited, perhaps where you are currently living – create alternative scenarios for urban development in 2020, 2030 and 2050 under the four different forms of climate-change future set out in Figure 1.1. Which do you think is most likely, and why? In small groups or with your class, role play a town meeting in which a decision has to be made to follow one of these scenarios – which argument wins, and why?

Further reading and resources

There are now a number of classic books and important reports on the topic of cities and climate change that provide additional references to this text:

This is an edited collection that contains a number of chapters that address questions of vulnerability and adaptation in different developing countries:

Bicknell, J., Dodman, D. and Satterthwaite, D. *et al.* (2009) *Adapting Cities to Climate Change: Understanding and Addressing the Development Challenges*. Earthscan, London.

The first book to examine urban responses to climate change, this sets out the context for the emergence of urban approaches to mitigation and examines the processes of policy-making and implementation in six case-study cities:

Bulkeley, H. and Betsill, M. M. (2003) *Cities and Climate Change: Urban Sustainability and Global Environmental Governance*. Routledge, London.

This book examines how world cities are responding to climate change, providing an overview of the global situation and detailed examples from several major cities, including London, New York and Shanghai:

Hodson, M. and Marvin, S. (2010) *World Cities and Climate Change: Producing Urban Ecological Security*. Open University Press, Milton Keynes.

This is a comprehensive analysis of urban climate-change challenges, illustrated with lots of cases and examples:

Rosenzweig, C., Solecki, B., Hammer, S. and Mehrota, S. (2011) *Climate Change and Cities: First Assessment Report of the Urban Climate Change Research Network*. Cambridge University Press, Cambridge.

This is a comprehensive analysis of the relationship between cities and climate change, with a website that contains several background studies on individual cities, as well as links to other reports on urban sustainable development:

UN-Habitat (2011) *Global Report on Human Settlements: Cities and Climate Change*. UN-Habitat, Nairobi, Kenya. Online: www.unhabitat.org/content.asp?typeid=19&catid=555&cid=9272.

This is an important landmark report from the World Bank on the topic of cities and climate change:

World Bank (2010) *Cities and Climate Change: An Urgent Agenda*. World Bank, Washington DC. Further documents and analysis available online at: <http://climatechange.worldbank.org/content/new-report-sees-cities-central-climate-action>.

The following electronic resources provide different ways in which virtual cities are being created as a means through which to explore different ways of responding to climate change:

- www.greenpeace.org.uk/EfficienCity – virtual city used as an information portal on different energy technologies.
- www.electrocity.co.nz/Resources/ – New Zealand energy-company website designed for high-school students but useful for examining different kinds of alternative and the implications for decision-makers.
- www-01.ibm.com/software/solutions/soa/innov8/cityone/index.html – designed to simulate real-world decisions across different urban sectors and enable players to share their experience globally.

For one imagined view of the city and climate change, see *Postcards from the Future*: www.postcardsfromthefuture.co.uk/.

Bibliography

- Adelekan, I. O. (2010) Vulnerability of poor urban coastal communities to flooding in Lagos, Nigeria, *Environment and Urbanization*, 22(2): 433–50.
- Adger, W. N., Arnell, N. A. and Tompkins, E. L. (2005) Successful adaptation to climate change across scales, *Global Environmental Change*, 15(2): 77–86.
- Adger, W. N., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D. R., Naess, L. O., Wolf, J. and Wreford, A. (2009) Are there social limits to adaptation to climate change? *Climatic Change*, 93: 335–54.
- Ahammad, R. (2011) Constraints of pro-poor climate change adaptation in Chittagong City, *Environment and Urbanization*, 23(2): 503–15.
- Akinbami, J. F. and Lawal, A. (2009) *Opportunities and challenges to electrical energy conservation and CO₂ emissions reduction in Nigeria's building sector*. Paper prepared for the Fifth Urban Research Symposium, Cities and Climate Change: Responding to an Urgent Agenda, 28–30 June, Marseille, France.
- Alam, M. and Golam Rabbani, M. D. (2007) Vulnerabilities and responses to climate change for Dhaka, *Environment and Urbanization*, 19(1): 81–97.
- Alber, G. and Kern, K. (2008) Governing climate change in cities: modes of urban climate governance in multi-level systems. *Proceedings of the OECD Conference on Competitive Cities and Climate Change*. OECD, Paris.
- Allen, J. (2004) The whereabouts of power: politics, government and space, *Geografiska Annaler*, 86B(1): 19–32.
- Allman, L., Fleming, P. and Wallace, A. (2004) The progress of English and Welsh local authorities in addressing climate change, *Local Environment*, 9(3): 271–83.
- Anguelovski, I. and Carmin, J. (2011) Something borrowed, everything new: innovation and institutionalization in urban climate governance, *Current Opinion in Environmental Sustainability*, 3: 169–175.
- Arup (2011a) Infographic: how are cities tackling climate change? Online: www.arup.com/Homepage_Cities_Climate_Change.aspx#!b:/Homepage_Cities_Climate_Change/Infographic.aspx (accessed January 2012).
- Arup (2011b) *Climate Action in Mega Cities: C40 cities baseline and opportunities*, Version 1.0, June, ARUP.
- Aulisi, A., Larsen, J., Pershing, J. and Posner, P. (2007) *Climate Policy in the State Laboratory: How States Influence Federal Regulation and the Implications for*

- Climate Change Policy in the United States*. World Resources Institute, Washington DC.
- Aylett, A. (2010) Municipal bureaucracies and integrated urban transitions to a low carbon future, in Bulkeley, H., Castán Broto, V., Hodson, M. and Marvin, S. (Eds) *Cities and Low Carbon Transition*, Routledge, Abingdon and New York, pp. 142–58.
- Aylett, A. (2011) Changing Perceptions of Climate Mitigation Among Competing Priorities: The Case of Durban, South Africa, in *Cities and Climate Change: Global Report on Human Settlements 2011*, UN-HABITAT.
- Bai, X. (2007) Integrating global environmental concerns into urban management: the scale and readiness arguments, *Journal of Industrial Ecology*, 11(2): 15–29.
- Bartlett, S. (2008) Climate change and urban children: impacts and implications for adaptation in low-and middle-income countries, *Environment and Urbanization*, 20(2): 501–19.
- Bernstein, S. (2001) *The Compromise of Liberal Environmentalism*. Columbia University Press, New York.
- Berrang-Ford, L., Ford, J. D. and Paterson, J. (2011) Are we adapting to climate change? *Global Environmental Change*, 21: 25–33.
- Betsill, M. M. and Bulkeley, H. (2006) Cities and the multilevel governance of global climate change, *Global Governance*, 12(2): 141–59.
- Betsill, M. and Bulkeley, H. (2007) Looking back and thinking ahead: a decade of cities and climate change research, *Local Environment: The International Journal of Justice and Sustainability*, 12(5): 447–56.
- Bicknell, J., Dodman, D. and Satterthwaite, D. (Eds) (2009) *Adapting Cities to Climate Change: Understanding and Addressing the Development Challenges*. Earthscan, London.
- Bioregional (2009) Capital consumption: the transition to sustainable consumption and production in London, November 2009, Bioregional and London Sustainable Development Commission. Online: www.bioregional.com/files/publications/capital-consumption.pdf (accessed January 2012).
- Birkmann, J., Garschagen, M., Kraas, F. and Quang, N. (2011) Adaptive urban governance: new challenges for the second generation of urban adaptation strategies to climate change, *Sustainability Science*, 5: 185–206.
- Birkmann, J. and von Teichman, K. (2010) Integrating disaster risk reduction and climate change adaptation: key challenges – scales, knowledge, and norms, *Sustainability Science*, 5: 171–84.
- Blake, J. (1999) Overcoming the ‘value–action gap’ in environmental policy: tensions between national policy and local experience, *Local Environment*, 4: 257–78.
- Brody, S. D., Zahran, S., Vedlitz, A. and Grover, H. (2008) Examining the relationship between physical vulnerability and public perceptions of global climate change in the United States, *Environment and Behavior*, 40(1): 72–95.
- Brotherhood of St Laurence (2012) Climate change. Online: www.bsl.org.au/Research-and-Publications/Research-and-Policy-Centre/Climate-change

- Bulkeley, H. (2000) Down to earth: local government and greenhouse policy in Australia, *Australian Geographer*, 31(3): 289–308.
- Bulkeley, H. (2001) No regrets? Economy and environment in Australia's domestic climate change policy process, *Global Environmental Change*, 11: 155–69.
- Bulkeley, H. (2009) Planning and governance of climate change, in Davoudi, S., Crawford, J. and Mehmood, A. (Eds) *Planning for Climate Change Strategies for Mitigation and Adaptation for Spatial Planners*, Earthscan, London.
- Bulkeley, H. (2010) Cities and the governing of climate change, *Annual Review of Environment and Resources*, 35: 229–53.
- Bulkeley, H. (2012, forthcoming) Climate change and urban governance: a new politics? In Lockie, S., Sonnenfeld, D. and Fisher, D. (Eds) *International Handbook of Social and Environmental Change*, Routledge, London.
- Bulkeley, H. and Betsill, M. M. (2003) *Cities and Climate Change: Urban Sustainability and Global Environmental Governance*, Routledge, London.
- Bulkeley, H. and Betsill, M. M. (2011) Revisiting the urban politics of climate change, submitted to *Environmental Politics*, in revised form, June 2012.
- Bulkeley, H. and Castán Broto, V. (2012a) Government by experiment? Global cities and the governing of climate change, revised for *Transactions of the Institute of British Geographers* (awaiting acceptance).
- Bulkeley, H. and Castán Broto, V. (2012b) Urban experiments and the governance of climate change: towards Zero Carbon Development in Bangalore, *Contemporary Social Science*, accepted subject to revision.
- Bulkeley, H. and Kern, K. (2006) Local government and climate change governance in the UK and Germany, *Urban Studies*, 43: 2237–59.
- Bulkeley, H. and Newell, P. (2010) *Governing Climate Change*, Routledge, Abingdon.
- Bulkeley, H. and Schroeder, H. (2009) *Governing Climate Change Post-2012: The Role of Global Cities – Melbourne*. Tyndall Centre for Climate Change Research Working Paper 138.
- Bulkeley, H., Schroeder, H., Janda, K., Zhao, J., Armstrong, A., Chu, S. Y. and Ghosh, S. (2009) *Cities and Climate Change: The Role of Institutions, Governance and Urban Planning*. Report for the World Bank Urban Research Symposium: Cities and Climate Change.
- Bulkeley, H., Watson, M. and Hudson, R. (2007) Modes of governing municipal waste, *Environment and Planning A*, 39(11): 2733–53.
- C40 (2011a) Fact Sheet: Why Cities? Online: <http://c40citieslive.squarespace.com/storage/FACTper cent20SHEETper cent20Whyper cent20Cities.pdf> (accessed October 2011).
- C40 (2011b) C40 Releases Groundbreaking Research on the Importance and Impact of Cities on Climate Change. Online: c40citieslive.squarespace.com/storage/C40%20Research%20Press%20Release.pdf (accessed January 2012).
- C40 Cities (2011c) C40 São Paulo Summit. Retrieved 26 January 2012 from www.c40saopaulosummit.com/site/conteudo/index.php?in_secao=26

- C40 Cities (2011d) C40 São Paulo Summit letter to Rio + 20, United Nations Conference on Sustainable Development. Retrieved 26 January 2012 from www.c40saopaulosummit.com/site/conteudo/index.php?in_secas=37&ib_home=1
- C40 Cities (2012) C40 Voices: Adalberto Maluf reports on recent advances in São Paulo's bus transit strategy. Online: <http://live.c40cities.org/blog/2012/1/12/c40-voices-adalberto-maluf-reports-on-recent-advances-in-sao.html>
- Carbon Disclosure Project (2008) *CDP cities 2011: Global report on C40 cities*, CDP/KPMG. Online: https://www.cdproject.net/CDPResults/65_329_216_CDP-CitiesReport.pdf.
- CFU (2010a) *Carbon Finance at the World Bank*. World Bank, Washington DC.
- CFU (2010b) *A City-wide Approach to Carbon Finance*. World Bank, Washington DC.
- Carter, J. G. (2011) Climate change adaptation in European cities, *Current Opinion in Environmental Sustainability*, 3: 193–8.
- Cartwright, A. (2008) Final report: sea-level rise adaptation and risk mitigation measures for the city of Cape Town, prepared by by Anton Cartwright (SEI Cape Town) in collaboration with Professor G. Brundrit and Lucinda Fairhurst, July 2008. Online: www.capetown.gov.za/en/EnvironmentalResourceManagement/publications/Documents/Phase%204%20-%20SLRRA%20Adaptation+Risk%20Mitigation%20Measures.pdf.
- Castán Broto, V. and Bulkeley. H. (2012) A survey of urban climate change experiments in 100 global cities, submitted to *Global Environmental Change*.
- Castleton, H. F., Stovin, V., Beck, S. B. M. and Davison, J. B. (2010) Green roofs: building energy savings and the potential for retrofit, *Energy and Buildings*, 42: 1582–91.
- CDP (2008) Carbon Disclosure Project Cities Pilot Project 2008, Report by the CDP for ICLEI US, available online: www.cdproject.net/CDPResults/65_329_216_CDP-CitiesReport.pdf (accessed February 2012).
- Chatterjee, M. (2010) Slum dwellers response to flooding events in the megacities of India, *Mitigation and Adaptation Strategies for Global Change*, 15: 337–53.
- City of Cape Town Environmental Resources Management Department (2009) *Enviroworks: Special Edition Energy and Climate Change*. Online: www.capetown.gov.za/en/EnvironmentalResourceManagement/publications/Documents/Enviroworks_Dec09.pdf (accessed January 2012).
- City of London (2010) *Rising to the Challenge – The City of London Climate Change Adaptation Strategy*. First published May 2007; revised and updated January 2010. City of London. Online: www.cityoflondon.gov.uk/services/environment-and-planning/sustainability/Documents/pdfs/SUS_AdaptationStrategyfinal_2010_update.pdf.
- City of Melbourne (2008) Zero Net Emissions by 2020 Update, Arup Pty Ltd for the City of Melbourne, Melbourne, City of Melbourne.
- City of Melbourne (2012) CH2 – Water conservation. Online: <http://www.melbourne.vic.gov.au/Sustainability/CH2/aboutch2/Pages/WaterConservation.aspx>.
- City of Philadelphia (2007) Local action plan for climate change, Sustainability Working Group, April 2007. Online: www.dvgbc.org/green_resources/library/city-philadelphia-local-action-plan-climate-change, last accessed 30 June 2011.

- City of Philadelphia (2009) Greenworks Philadelphia, City of Philadelphia, Mayor's Office of Sustainability. Online: www.phila.gov/green/greenworks/2009-greenworks-report.html, last accessed 30 June 2011.
- City of Philadelphia (2011) *Greenworks Philadelphia 2011 Progress Report*, City of Philadelphia, Mayor's Office of Sustainability.
- Coafee, J. and Healy, P. (2003) My voice my place: tracking transformations in urban governance, *Urban Studies*, 40(10): 1979–99.
- Collier, U. (1997) Local authorities and climate protection in the European Union: putting subsidiarity into practice? *Local Environment*, 2: 39–57.
- Commission on Climate Change and Development (2009) *Closing the Gaps: Disaster Risk Reduction and Adaptation to Climate Change in Developing Countries*, Commission on Climate Change and Development, Stockholm, Sweden.
- Community Pathways (2012) Carbon rationing action group (CRAG) or energy saving club, available online: <http://www.communitypathways.org.uk/approach/439/full> (accessed September 2012).
- Copenhagen Climate Communiqué (2009) Copenhagen Climate Communiqué, Copenhagen 2009. Online: www.kk.dk/Nyheder/2009/December/~media/B5A397DC695C409983462723E31C995E.ashx, last accessed January 2012.
- Corburn, J. (2009) Cities, climate change and urban heat island mitigation: localising global environmental science, *Urban Studies*, 46(2): 413–27.
- Corfee-Morlot, J., Cochran, I., Hallegate, S. and Teasdale, P. J. (2011) Multilevel risk governance and urban adaptation policy, *Climatic Change*, 104: 169–97.
- Coutard, O. and Rutherford, J. (2010) The rise of post-network cities in Europe? Recombining infrastructural, ecological and urban transformation in low carbon transitions, in Bulkeley, H., Castán Broto, V., Hodson, M. and Marvin, S. (Eds) *Cities and Low Carbon Transition*, Routledge, Abingdon, pp. 107–25.
- Covenant of Mayors (2011a) About the covenant. Online: www.eumayors.eu/about/covenant-of-mayors_en.html (accessed January 2012).
- Covenant of Mayors (2011b) Welcome. Online: www.eumayors.eu/home_en.htm (accessed January 2012).
- Davoudi, S., Crawford, J. and Mehmood, A. (Eds) (2009) *Planning for Climate Change: Strategies for Mitigation and Adaptation for Spatial Planners*. Earthscan, UK and USA.
- Department for Communities and Local Government (2007) *Improving the Flood Performance of New Buildings: Flood Resilient Construction*, Department for Communities and Local Government, London.
- Dhakar, S. (2011) *Urban energy transitions in Chinese cities*, in Bulkeley, H., Castrán Broto, V., Hodson, M., Marvin, S. (Eds) *Cities and Low Carbon Transitions*, Routledge, pp. 73–87.
- Dockside Green (2012) A better approach. Online: www.docksidegreen.com/Sustainability/Ecology.aspx (accessed January 2012).
- Dodman, D. (2009) Blaming cities for climate change? An analysis of urban greenhouse gas emissions inventories. *Environment and Urbanization*, 21(1): 185–201.

- Dodman, D., Kibona, E. and Kiluma, L. (2011) Tomorrow is too late: responding to social and climate vulnerability in Dar es Salaam, Tanzania, case study prepared for *Cities and Climate Change: Global Report on Human Settlements 2011*. Online: www.unhabitat.org/grhs/2011 (accessed January 2012).
- Douglas, I., Alam, K., Maghenda, M., McDonnell, Y., McLean, L. and Campbell, J. (2008) Unjust waters: climate change, flooding and the urban poor in Africa, *Environment and Urbanization*, 20: 187–205.
- Dubeux, C. and La Rovere, E. (2011) The contribution of urban areas to climate change: the case study of São Paulo, Brazil, case study prepared for *Cities and Climate Change: Global Report on Human Settlements 2011*.
- Eakin, H. and Lemos, M. C. (2006) Adaptation and the state: Latin America and the challenge of capacity-building under globalization, *Global Environmental Change*, 16(1): 7–18.
- Eakin, H., Lerner, A. M. and Murtinho, F. (2010) Adaptive capacity in evolving peri-urban spaces: responses to flood risk in the Upper Lerma River Valley, Mexico, *Global Environmental Change*, 20: 14–22.
- Environment Agency (2011) Thames Estuary 2100. Online: www.environment-agency.gov.uk/homeandleisure/floods/104695.aspx (accessed December 2011).
- European Environment Agency (2011) Greenhouse gas emission trends and projections in Europe 2011 – Tracking progress towards Kyoto and 2020 targets. Online: www.eea.europa.eu/publications/ghg-trends-and-projections-2011 (accessed January 2012).
- Evans, J. P. (2011) Resilience, ecology and adaptation in the experimental city, *Transactions of the Institute of British Geographers*, 36: 223–37.
- Farrelly, M. and Brown, R. (2011) Rethinking urban water management: experimentation as a way forward? *Global Environmental Change*, 21(2): 721–32.
- Fisher, D., Connolly, J., Svendsen, E. and Campbell, L. (2011) *Digging Together: Why People Volunteer to Help Plant One Million Trees in New York City*. Environmental Stewardship Project at the Center for Society and Environment of the University of Maryland White Paper 1.
- Foresight (2008) *Powering our Lives: Sustainable Energy Management and the Built Environment*. Final Project Report, The Government Office for Science, London.
- Friends of the Earth Hong Kong (2011) Friends of the Earth Power Smart Contest 2011. Online: www.foe.org.hk/powersmart/2011/e_index.html (accessed January 2012).
- Geels, F. W. (2002) Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case study, *Research Policy*, 31(8–9): 1257–74.
- Geels, F. W. and Kemp, R. (2007) Dynamics in socio-technical systems: typology of change processes and contrasting case studies, *Technology in Society*, 29: 441–55.
- Global Cool Cities Alliance (2012) What is global cool cities alliance? Online: www.globalcoolcities.org/ (accessed January 2012).
- Gore, C. and Robinson, P. (2009) Local government response to climate change: our last, best hope? in Selin, H. and VanDeveer, S. D. (Eds) *Changing Climates in*

- North American Politics: Institutions, Policymaking and Multilevel Governance*, MIT Press, Cambridge, MA, pp. 138–58.
- Gore, C., Robinson, P. and Stren, R. (2009) *Governance and Climate Change: Assessing and Learning from Canadian Cities*. Fifth Urban Research Symposium Cities and Climate Change: Responding to an Urgent Agenda, Marseille.
- Graham, S. and Marvin, S. (2001) *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*. Routledge, London.
- Granberg, M. and Elander, I. (2007) Local governance and climate change: reflections on the Swedish experience, *Local Environment*, 12: 537–48.
- Greater London Authority (2007) *Action Today to Protect Tomorrow: the Mayor's Climate Change Action Plan*, Greater London Authority, London, February.
- Greater London Authority (2012) London heat map: welcome. Online: www.londonheatmap.org.uk/Content/home.aspx
- Gurran, N., Hamin, E. and Norman B. (2008) *Planning for Climate Change: Leading Practice Principles and Models for Sea Change Communities in Coastal Australia*, Report no. 3 for the National Sea Change Taskforce, July 2008.
- Gustavsson, E., Elander, I. and Lundmark, M. (2009) Multilevel governance, networking cities, and the geography of climate-change mitigation: two Swedish examples, *Environment and Planning C: Government and Policy*, 27: 59–74.
- Hammer, S. (2009) *Capacity to act: the critical determinant of local energy planning and program implementation*. Paper presented at the Fifth Urban Research Symposium, Cities and Climate Change: Responding to an Urgent Agenda, Marseille.
- Handmer, J. W. and Dovers, S. R. (1996) A typology of resilience: rethinking institutions for sustainable development, *Organization and Environment*, 9(4): 482–511.
- Hanson, S., Nichols, R., Ranger, N., Hallegate, S., Corfee-Morlot, J. C., Herweijer, C. and Chateau, J. (2011) A global ranking of port cities with high exposure to climate extremes, *Climatic Change*, 104: 89–111.
- Hardoy, J. and Pandiella, G. (2009) Urban poverty and vulnerability to climate change in Latin America, *Environment and Urbanization*, 21: 203–24.
- Hardoy, J. and Romero-Lankao, P. (2011) Latin American cities and climate change: challenges and options to mitigation and adaptation responses, *Current Opinion in Environmental Sustainability*, 3: 1–6.
- Hargreaves, T., Burgess, J. and Nye, M. (2010) Making energy visible: a qualitative field study of how householders interact with feedback from smart energy monitors, *Energy Policy*, 38(10): 6111–19.
- Harries, T. and Penning-Roswell, E. (2011) Victim pressure, institutional inertia and climate change adaptation, *Global Environmental Change*, 21: 188–97.
- Hegger, D. L. T., Van Vliet, J. and Van Vliet, B. J. M. (2007) Niche management and its contribution to regime change: the case of innovation in sanitation, *Technology Analysis & Strategic Management*, 19(6): 729–46.
- Hillmar-Pegram, K. C., Howe, P. D., Greenberg, H. and Yarnal, B. (2011) A geographic approach to facilitating local climate governance: from emissions inventories to mitigation planning, *Applied Geography*, 34: 76–85.

- Hobson, K. and Neimeyer, S. (2011) Public responses to climate change: the role of deliberation in building, *Global Environmental Change*, 21: 957–71.
- Hodson, M. and Marvin, S. (2009) ‘Urban ecological security’: a new urban paradigm? *International Journal of Urban and Regional Research*, 33(1): 193–215.
- Hodson, M. and Marvin, S. (2010) *World Cities and Climate Change: Producing Urban Ecological Security*. Open University Press, Milton Keynes.
- Hoffman, M. (2009) *Experimenting with Climate Governance*. 2009 Conference on the Human Dimensions of Global Environmental Change – Earth System Governance: People, Places and the Planet, Amsterdam.
- Hoffmann, M. J. (2011) *Climate Governance at the Crossroads: Experimenting with a Global Response after Kyoto*. Oxford University Press, Oxford.
- Holgate, C. (2007) Factors and actors in climate change mitigation: a tale of two South African cities. *Local Environment*, 12(5): 471–84.
- Hommels, A. (2005). Studying Obduracy in the City: Toward a Productive Fusion between Technology Studies and Urban Studies, *Science, Technology & Human Values*, 30: 323–51.
- Hoornweg, D., Sugar, L. and Gomez, C. L. T. (2011) Cities and greenhouse gas emissions: moving forward, *Environment and Urbanization*, 23(1): 207–27.
- Hulme, M. (2009) *Why We Disagree About Climate Change*. Cambridge University Press, Cambridge.
- Hunt, A. and Watkiss, P. (2011) Climate change impacts and adaptation in cities: a review of the literature, *Climatic Change*, 104: 13–49.
- Huq, S., Kovats, S., Reid, H. and Satterthwaite, D. (2007) Reducing risks to cities from disasters and climate change, *Environment and Urbanization*, 19(3): 3–15.
- ICLEI (1997) *Local Government Implementation of Climate Protection: Report to the United Nations*. International Council for Local Environmental Initiatives, Toronto.
- ICLEI (2006) *ICLEI International Progress Report – Cities for Climate Protection*. ICLEI, Oakland.
- ICLEI Australia (2008) *Local Government Action on Climate Change: Measures Evaluation Report 2008*. Australian Government Department of Environment, Water, Heritage and the Arts and ICLEI, Melbourne, Australia. Online: http://www.iclei.org/fileadmin/user_upload/documents/Global/Programs/CCP/CCP_Reports/ICLEI_CCP_Australia_2008.pdf
- ICLEI Australia (2009) CCP Australia December 2008–January 2009. Online: www.iclei.org/index.php?id=9264#c34751 (accessed January 2012).
- ICLEI (2009) *International Local Government GHG Emissions Analysis Protocol Version 1.0 (October 2009)*. Online: www.iclei.org/index.php?id=ghgprotocol
- ICLEI (2011) *Global Standard on Cities Greenhouse Gas Emissions – C40 and ICLEI MoU*. Online: www.iclei.org/index.php?id=1487&tx_ttnewspercent5Btt_newspercent5D=4643&tx_ttnewspercent5BbackPidpercent5D=983&cHash=712a8184bb
- ICLEI (2012) *The Five Milestone Process*. Online: www.iclei.org/index.php?id=810 (accessed January 2012).

- IPCC (2007a) Synthesis report: summary for policy-makers 1. Online: www.ipcc.ch/publications_and_data/ar4/syr/en/spms1.html (accessed January 2012).
- IPCC (2007b) *Climate Change 2007: Working Group III: Mitigation of Climate Change – Glossary E-I*. Online: www.ipcc.ch/publications_and_data/ar4/wg3/en/annex1-ensglossary-e-i.html (accessed January 2012).
- IPCC (2007c) Synthesis report: summary for policy-makers 2. Online: www.ipcc.ch/publications_and_data/ar4/syr/en/spms2.html (accessed January 2012).
- IPCC (2007d) Synthesis report: summary for policy-makers 3. Online: www.ipcc.ch/publications_and_data/ar4/syr/en/spms3.html (accessed January 2012).
- IPCC (2007e) *Climate Change 2007: Working Group II: Impacts, Adaptation and Vulnerability – Glossary A-D*. Online: www.ipcc.ch/publications_and_data/ar4/wg2/en/annexessglossary-a-d.html (accessed January 2012).
- IPCC (2007f) *Climate Change 2007: Working Group II: Impacts, Adaptation and Vulnerability – Glossary P-Z*. Online: www.ipcc.ch/publications_and_data/ar4/wg2/en/annexessglossary-p-z.html
- International Energy Agency (2008) *World Energy Outlook 2008*. International Energy Agency, Paris.
- International Energy Agency (2009) *Cities, Towns and Renewable Energy: Yes in My Front Yard*. IEA, Paris.
- Jackson, B., Lee-Woolf, C., Higginson, F., Wallace, J. and Agathou, N. (2009) *Strategies for reducing the climate impacts of red meat/dairy consumption in the UK*. WWF/Imperial College London, London. Online: http://assets.wwf.org.uk/downloads/imperialwwf_report.pdf (accessed January 2012).
- Jessup, B. and Mercer, D. (2001) Energy policy in Australia: a comparison of environmental considerations in New South Wales and Victoria, *Australian Geographer*, 32(1): 7–28.
- Jollands, N. (2008) *Cities and Energy: A Discussion Paper*. OECD International Conference on Competitive Cities and Climate Change. OECD, Milan.
- Jones, L. and Boyd, E. (2011) Exploring social barriers to adaptation: insights from Western Nepal, *Global Environmental Change*, 21: 1262–74.
- Joss, S. (2010) Ecocities: a global survey, *WIT Transactions on Ecology and The Environment*, 129: 239–50.
- Karl, T. R., Melillo, J. M. and Peterson, T. C. (Eds) (2009) *Global Climate Change Impacts in the United States*. Cambridge University Press, New York.
- Kennedy, C., Pinsetl, S. and Bunje, P. (2010) The study of urban metabolism and its applications to urban planning and design, *Environmental Pollution*, 159: 1965–73.
- Kern, K. and Bulkeley, H. (2009) Cities, Europeanization and multi-level governance: governing climate change through transnational municipal networks, *Journal of Common Market Studies*, 47: 309–32.
- Kiithia, J. (2011) Climate change risk responses in East African cities: need, barriers and opportunities, *Current Opinion in Environmental Sustainability*, 3: 1–5.
- Kingdon, R. W. (1984) *Agenda, Alternatives and Public Policies*. Longman, London.

- Kirshen, P., Ruth, M. and Anderson, W. (2008) Interdependencies of urban climate change impacts and adaptation strategies: a case study of Metropolitan Boston USA, *Climatic Change*, 86: 105–22.
- Koehn, P. H. (2008) Underneath Kyoto: emerging subnational government initiatives and incipient issue-bundling opportunities in China and the United States, *Global Environmental Politics*, 8(1): 53–77.
- Krause, R. M. (2011) Symbolic or substantive policy? Measuring the extent of local commitment to climate protection, *Environment and Planning C: Government and Policy*, 29(1): 46–62.
- Lambright, W. H., Chagnon, S. A. and Harvey, L. D. D. (1996) Urban reactions to the global warming issue: agenda setting in Toronto and Chicago, *Climatic Change*, 34: 463–78.
- Lasco, R., Lebel, L., Sari, A., Mitra, A. P., Tri, N. H. (Eds) (2007) *Integrating Carbon Management Into Development Strategies of Cities – Establishing a Network of Case Studies of Urbanisation in Asia Pacific*. Final Report for the APN project 2004–07-CMY-Lasco.
- Laukkonen, J., Blanco, P. K., Lenhart, J., Keiner, M., Cavric, B. and Kinuthia-Njenga, C. (2009) Combining climate change adaptation and mitigation measures at the local level, *Habitat International*, 33: 287–92.
- Leach, R. and Percy-Smith, J. (2001) *Local governance in Britain*. Palgrave Macmillan, London.
- Lebel, L., Huaisai, D., Totrakool, D., Manuta, J. and Garden, P. (2007) A carbon's eye view of urbanization in Chiang Mai: improving local air quality and global climate protection, in Lasco, R., Lebel, L., Sari, A., Mitra, A. P., Tri, N. H. *et al.* (Eds) *Integrating Carbon Management Into Development Strategies of Cities – Establishing a Network of Case Studies of Urbanisation in Asia Pacific*. Final Report for the APN project 2004–07-CMY-Lasco, pp. 98–124.
- Leichenko, R. (2011) Climate change and urban resilience, *Current Opinion in Environmental Sustainability*, 3: 164–8.
- Levine, S., Ludi, E. and Jones, L. (2011) *Rethinking Support for Adaptive Capacity to Climate Change*. Overseas Development Institute, London. Online: <http://policy-practice.oxfam.org.uk/publications/rethinking-support-for-adaptive-capacity-to-climate-change-198311> (accessed January 2012).
- Li, J. (2011) Decoupling urban transport from GHG emissions in Indian cities – a critical review and perspectives, *Energy Policy*, 39: 3503–14.
- de Loë, R., Kreutzwiser, R. and Moraru, L. (2001) Adaptation options for the near term: climate change and the Canadian water sector, *Global Environmental Change*, 11: 231–45.
- LogiCity (2012) Introduction. Online: www.logicity.co.uk/ (accessed January 2012).
- London Climate Change Agency (2007) *Moving London Towards a Sustainable Low-Carbon City: An Implementation Strategy*. London Climate Change Agency, London, June.
- London Development Agency (2012) *Low Carbon Economy*. Online: www.lda.gov.uk/our-work/low-carbon-future/low-carbon-economy/index.aspx (accessed February 2012).

- López-Marrero, T. and Tschakert, P. (2011) From theory to practice: building more resilient communities in flood-prone areas, *Environment and Urbanization*, 23(1): 229–49.
- Lovelock, J. (2009) *The Vanishing Face of Gaia: A Final Warning*. Allen Lane, London.
- Low Carbon Trust (2012) Low Carbon Trust. Online: www.lowcarbon.co.uk/home
- Liu, J. and Deng, X. (2011) Impacts and mitigation on climate change in Chinese cities, *Current Opinion in Environmental Sustainability*, 3: 1–5.
- Lynas, M. (2004) *Six Degrees: Our Future on a Hotter Planet*. Harper Perennial, London.
- McEwan, I. (2010) *Solar*. Jonathan Cape, London.
- McGranahan, G., Deborah Balk and Bridget Anderson (2007) The rising tide: assessing the risks of climate change and human settlements in the low elevation coastal zone, *Environment and Urbanization*, 19: 17–37.
- McKibben, B. (2011) *Eaarth: Making a Life on a Tough New Planet*. St Martin's Griffin, New York.
- Manuel-Navarrete, D., Pelling, M. and Redclift, M. (2011) Critical adaptation to hurricanes in the Mexican Caribbean: development visions, governance structures, and coping strategies, *Global Environmental Change*, 21: 249–58.
- Measham, T. G., Preston, B. L., Smith, T. F., Brooke, C., Gorddard, R., Withycombe, G. and Morrison, C. (2011) Adapting to climate change through local municipal planning: barriers and challenges, *Mitigation and Adaptation Strategies for Global Change*, 16: 889–909.
- Moreland Solar City (2011) Energy Hub. Online: www.morelandsolarcity.org.au/our-programs/energy-hub (accessed January 2012).
- Moser, S. C., Kaspersen, R. E., Yohe, G. and Agyeman, J. (2008) Adaptation to climate change in the Northeast United States: opportunities, processes and constraints, *Mitigation and Adaptation Strategies for Global Change*, 13: 643–59.
- NAGA (2006) Northern Alliance for Greenhouse Action Strategic Plan. NAGA, Melbourne.
- NAGA (2008) Towards zero net emissions in the NAGA region. NAGA, Melbourne, December.
- Neuhäuser, A. (2010) *KWK Modellstadt Berlin – Energy Efficiency in Energy Consumption*. Online: www.kwk-modellstadt-berlin.de/media/file/95.Achim-Neuh%E4user-Berlin-Energy-Agency.pdf
- NCC (2012) City consumption. Online: www.newcastle.nsw.gov.au/environment/climate_cam/climatecam (accessed January 2012).
- Newman, P. and Kenworthy, J. (1999) *Sustainability and Cities: Overcoming Automobile Dependence*. Island Press, Washington DC.
- Nickson, A. (2011) Cities and climate change: adaptation in London, UK, case study prepared for *Cities and Climate Change, Global Report on Human Settlements*. Online: www.unhabitat.org/downloads/docs/GRHS2011/GRHS2011CaseStudyChapter06London.pdf (accessed January 2012).

- North, P. J. (2010) Eco-localisation as a progressive response to peak oil and climate change – a sympathetic critique, *Geoforum*, 41(4): 585–94.
- Owens, S. (1992) Energy, environmental sustainability, and land-use planning, in Breheny, M. (Ed.) *Sustainable Development and Urban Form*, Pion, London, pp. 79–105.
- Oxford is My World (2012) Welcome to Oxford is My World. Online: www.oxfordismyworld.org/ (accessed January 2012).
- Padeco (2010) *Cities and Climate Change Mitigation: Case Study on Tokyo's Emissions Trading System*. World Bank, Washington DC.
- Paterson, M. (1996) *Global Warming and Global Politics*. Routledge, London.
- Paterson, M. (2007) *Automobile Politics: Ecology and Cultural Political Economy*. Cambridge University Press, Cambridge.
- Pearce, F. (2009) Greenwash: the dream of the first eco-city was built on a fiction, *The Guardian*, 23 April.
- Pelling, M. (2011a) *Adaptation to Climate Change: From Resilience to Transformation*. Taylor & Francis Books, London.
- Pelling, M. (2011b) Urban governance and disaster risk reduction in the Caribbean: the experiences of Oxfam, GB, *Environment and Urbanization*, 23(2): 383–400.
- Pew Centre (2011) *Adaptation Planning – What US States and Localities Are Planning*. Pew Centre, Washington DC.
- Pickerill, J. (2010) Building liveable cities: low impact developments as low carbon solutions? in Bulkeley, H., Castán Broto, V., Hodson, M. and Marvin, S. *Cities and Low Carbon Transitions*. Routledge, pp. 178–97.
- Pitt, D. R. (2010) The impact of internal and external characteristics on the adoption of climate mitigation policies by US municipalities, *Environmental and Planning C: Government and Policy*, 28(5): 851–71.
- Prefeitura Do Município De São Paulo (2009) Lei 14.933 de 5 de Junho de 2009. São Paulo.
- Prefeitura Do Município De São Paulo (2011) Diretrizes para o Plano de Ação da Cidade de São Paulo para Mitigação e Adaptação às Mudanças Climáticas. São Paulo.
- Project Dirt (2012) Transition Towns. Online: <http://projectdirt.com/page/transition-towns>
- Puppim de Oliveira, J. (2009) The implementation of climate change related policies at the subnational level: an analysis of three countries, *Habitat International*, 33(3): 253–9.
- Qi, Y., Ma, L., Zhang, H. and Li, H. (2008) Translating a global issue into local priority: China's local government response to climate change, *Journal of Environment and Development*, 17(4): 379–400.
- Ranger, N., Hallegatte, S. *et al.* (2011) An assessment of the potential impact of climate change on flood risk in Mumbai, *Climate Change*, 104: 139–67.
- Raven, R. (2007) Niche accumulation and hybridization strategies in transition processes towards a sustainable energy system: An assessment of differences and pitfalls, *Energy Policy*, 35: 2390–400.

- Rawlani, A. K. and Sovacool, B. K. (2011) Building responsiveness to climate change through community based adaptation in Bangladesh, *Mitigation and Adaptation Strategies for Global Change*, 16: 845–63.
- Revi, A. (2008) Climate change risk: an adaptation and mitigation agenda for Indian cities, *Environment and Urbanization*, 20(1): 207–29.
- Roberts, D. (2010) Prioritizing climate change adaptation and local level resilience in Durban, South Africa, *Environment and Urbanization*, 22(2): 397–413.
- Robinson, P. and Gore, C. (2011) *The spaces in between: a comparative analysis of municipal climate governance and action*. Paper presented at the American Political Science Association, Annual Conference, 1–4 September, Seattle, WA.
- Romero-Lankao, P. (2007) How do local governments in Mexico City manage global warming? *Local Environment*, 12(5): 519–35.
- Romero-Lankao, P. (2010) Water in Mexico City: what will climate change bring to its history of water-related hazards and vulnerabilities? *Environment and Urbanization*, 22(1): 157–78.
- Rosenzweig, C., Major, D. C., Demong, K., Stanton, C., Horton, R. and Stults, M. (2007) Managing climate change risks in New York City's water system: assessment and adaptation planning, *Mitigation and Adaptation Strategies for Global Change*, 12: 1391–409.
- Rosenzweig, C., Solecki, B., Hammer, S. and Mehrota, S. (2011) *Climate Change and Cities: First Assessment Report of the Urban Climate Change Research Network*. Cambridge University Press, Cambridge.
- Rosenzweig, C. and Solecki, W. (2010) Introduction to 'Climate change adaptation in New York City: building a risk management response'. *Ann. New York Acad. Sci.*, 1196, 13–18.
- Rutland, T. and Aylett, A. (2008) The work of policy: actor networks, governmentality, and local action on climate change in Portland, Oregon, *Environment and Planning D: Society and Space*, 26(4): 627–46.
- Sanchez-Rodriguez, R., Fragkias, M. and Solecki, W. (2008) *Urban Responses to Climate Change a Focus on the Americas: A Workshop Report*. International Workshop Urban Responses to Climate Change, New York City.
- Sari, A. (2007) Carbon and the city: carbon pathways and decarbonization opportunities in Greater Jaxarta, Indonesia, in Lasco, R., Lebel, L., Sari, A., Mitra, P., Tri, N. H., Ling, O. G. and Contreras, A. (Eds) *Integrating Carbon Management Into Development Strategies of Cities: Establishing a Network of Case Studies of Urbanization in Asia Pacific*. Final Report for the APN project 2004–07, CMY, Lasco, pp. 125–51.
- Satterthwaite D. (2008a) Cities' contribution to global warming: notes on the allocation of greenhouse gas emissions, *Environment and Urbanization*, 20(2): 539–49.
- Satterthwaite, D. (2008b) *Climate Change and Urbanization: Effects and Implications for Urban Governance*. United Nations Expert Group Meeting on Population Distribution, Urbanization, Internal Migration and Development, UN/POP/EGM-URB/2008/16.

- Satterthwaite, D. (2011) Editorial: why is community action needed for disaster risk reduction and climate change adaptation? *Environment and Urbanization*, 23(2): 339–49.
- Satterthwaite, D., Huq, S., Pelling, M., Reid, H. and Romero-Lankao, P. (2008) *Adapting to Climate Change in Urban Areas: The Possibilities and Constraints in Low- and Middle-Income Nations*. IIED, London.
- Schreurs, M. A. (2008) From the bottom up: local and subnational climate change politics, *Journal of Environment and Development*, 17(4): 343–55.
- Scott, M., Gupta, S., Jáuregui, E., Nwafor, J., Satterthwaite, D., Wanasinghe, Y. A. D. S., Wilbanks, T., Yoshino, M., Kelkar, U., Mortsch, L. and Skea, J. (2001) Human settlements, energy, and industry. Climate change 2001: impacts, adaptation, and vulnerability, in McCarthy, J. J., Canziani, O. F., Leary, N. A., Dokken, D. J., White, K. S. (Eds) *Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, pp. 381–416.
- Seelig, S. (2011) A master plan for low carbon and resilient housing: the 35 ha area in Hashtgerd New Town, Iran, *Cities*, 28: 545–56.
- Setzer J. (2009) *Subnational and transnational climate change governance: evidence from the state and city of São Paulo, Brazil*. Paper presented at the Fifth World Bank Urban Research Symposium: Cities and Climate Change – Responding to an Urgent Agenda, Marseille.
- Seyfang, G. (2009) *The New Economics of Sustainable Consumption: Seeds of Change*. Palgrave Macmillan, Basingstoke.
- Seyfang, G. and Smith, A. (2007) Grassroots innovations for sustainable development: Towards a new research and policy agenda, *Environmental Politics*, 16: 584–603.
- Sharmer, D. and Tomar, S. (2010) Mainstreaming climate change adaptation in Indian cities, *Environment and Urbanization*, 22(2): 451–65.
- Short, J., Dender, K. V. and Crist, P. (2008) Transport policy and climate change, in Sperling, D. and Cannon, J. S. (Eds) *Reducing Climate Impacts in the Transportation Sector*. Springer-Verlag, New York, pp. 35–48.
- Shove, E. (2003) *Comfort, Cleanliness and Convenience: The Social Organization of Normality*. Berg, Oxford.
- Shove, E. (2010) Beyond the ABC: climate change policy and theories of social change, *Environment and Planning A*, 42(6): 1273–85.
- Smith, A. (2007) Translating sustainabilities between green niches and socio-technical regimes, *Technology Analysis and Strategic Management*, 19: 427–50.
- Smith, A. (2010) Community-led urban transitions and resilience: performing Transition Towns in a city, in Bulkeley, H., Castán Broto, V., Hodson, M. and Marvin, S. (Eds) *Cities and Low Carbon Transition*. Routledge, Abingdon and New York, pp. 159–77.
- Smith, A., Voß, J.-P. and Grin, J. (2010) Innovation studies and sustainability transitions: the allure of the multi-level perspective and its challenges, *Research Policy*, 39: 435–48.

- Solar American Cities (2011) *Boston Massachusetts*. Online: www.solaramericacities.energy.gov/Cities.aspx?City=Boston (accessed February 2012).
- Solar American Cities (2012) About. Online: <http://solaramericacommunities.energy.gov/about/> (accessed February 2012).
- Solecki, W., Leichenko, R. and O'Brien, K. (2011) Climate change adaptation strategies and disaster risk reduction in cities: connections, contentions, and synergies, *Current Opinion in Environmental Sustainability*, 3: 135–41.
- Source London (2012) *Source London*. Online: <https://www.sourcelondon.net/ScopeI>.
- SouthSouthNorth (2011) *Project Portfolio and Reports*. Online: www.southsouthnorth.org/ (accessed March 2011).
- State of Victoria (2005) *Victorian Greenhouse Strategy Action Plan Update*. The State of Victoria Department of Sustainability and Environment, Melbourne.
- Stern, N., Peters, S., Bakhshi, V., Bowen, A., Cameron, C., Catovsky, S., Crane, D., Cruickshank, S., Dietz, S., Edmonson, N., Garbett, S.-L., Hamid, L., Hoffman, G., Ingram, D., Jones, B., Patmore, N., Radcliffe, H., Sathiyarajah, R., Stock, M., Taylor, C., Vernon, T., Wanjie, H. and Zenghelis, D. (2006) *Stern Review: The Economics of Climate Change*. HM Treasury, London.
- Sugiyama, N. and Takeuchi, T. (2008) Local policies for climate change in Japan, *Journal of Environment and Development*, 17(4): 424–41.
- Swyngedouw, E. (2009) The antinomies of the postpolitical city: in search of a democratic politics of environmental production, *International Journal of Urban and Regional Research*, 33(3): 601–20.
- Sydney Olympic Park Authority (2012) Water and catchments. Online: www.sopa.nsw.gov.au/our_park/environment/water (accessed January 2012).
- The California Energy Commission (2012) Cool Roofs and Title 24. Online: www.energy.ca.gov/title24/coolroofs/ (accessed January 2012).
- The Carbon Trust (2012) Organizational carbon footprints. Online: www.carbontrust.co.uk/cut-carbon-reduce-costs/calculate/carbon-footprinting/pages/organisation-carbon-footprint.aspx (accessed January 2012).
- The Climate Group (2011) City partnerships. Online: www.theclimategroup.org/programs/city-partnerships/ (accessed January 2012).
- TMG (2008) Tokyo's proposals on nationwide introduction of cap-and-trade program in Japan, Tokyo Metropolitan Government, Tokyo.
- TMG (2009) Tokyo cap-and-trade program: Tokyo ETS. Tokyo Workshop 2009 on Urban Cap & Trade Towards a Low Carbon Metropolis, Tokyo.
- Tompkins, E. L., Adger, W. L., Boyd, E., Nicholson-Cole, S., Weatherhead, K. and Arnell, N. (2010) Observed adaptation to climate change: UK evidence of transition to a well-adapting society, *Global Environmental Change*, 20: 627–35.
- Toronto Environment Office (2008) *Ahead of the Storm: Preparing Toronto for Climate Change*. City of Toronto. Online: www.toronto.ca/teo/pdf/ahead_of_the_storm.pdf
- Toronto People's Assembly on Climate Justice (2011) People's Assembly on Climate Justice: Earth Day 2011. Online: <http://torontopeoplesassembly.wordpress.com/assemblies/earth-day-2011/> (accessed January 2012).

- Toronto People's Assembly on Climate Justice (2012) People's Assembly on Climate Justice: about. <http://torontopeoplesassembly.wordpress.com/about/> (accessed January 2012).
- Transition Town Brixton (2011a) About transition? Online: www.transitiontownbrixton.org/?s=About+transition&submit=Search (accessed March 2011).
- Transition Town Brixton (2011b) Buildings and energy. Online: www.transitiontownbrixton.org/category/groups/buildingsandenergy/ (accessed March 2011).
- Transition Town Network (2012) What is a transition initiative? Online: www.transitionnetwork.org/support/what-transition-initiative (accessed January 2012).
- UNFCCC (n.d.) Convention text. Online: http://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf (accessed January 2012).
- UNFCCC (1992) *United Nations Framework Convention on Climate Change*. United Nations, New York.
- UN-Habitat (2008) *State of the World's Cities 2008/2009 – Harmonious Cities*. Earthscan, London and Sterling, VA.
- UN-Habitat (2009) *Planning Sustainable Cities: Global Report on Human Settlements 2009*. Earthscan, London.
- UN-Habitat (2011) *Global Report on Human Settlements: Cities and Climate Change*. UN-Habitat, Nairobi, Kenya.
- Union of Concerned Scientists (2008) *Climate Change in Pennsylvania: Impacts and Solutions for the Keystone State*. Union of Concerned Scientists, Cambridge, MA, 54 pp. Online: www.northeastclimateimpacts.org/ (accessed January 2012).
- Urry, J. (2011) *Climate Change and Society*. Polity Press, Cambridge.
- van Vliet, B., Chappells, H. and Shove, E. (2005) *Infrastructures of Consumption: Environmental Innovation in the Utility*. Earthscan, London.
- While, A., Jonas, A. E. G. and Gibbs, D. (2010) From sustainable development to carbon control: eco-state restructuring and the politics of urban and regional development, *Transactions of the Institute of British Geographers*, 35: 76–93.
- Wilbanks, T. J., Romero-Lankao, P., Bao, M., Berkhout, F., Cairncross, S., Ceron, J. P., Kapshe, M., Muir-Wood, R. and Zapata-Marti, R. (2007) Industry, settlement and society, in Parry, M. L., Canziani, O. F., Palutikof, J. P., van der Linden, P. J. and Hansen, C. E. (Eds) *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, pp. 357–90.
- Willis, R., Webb, M. and Wilsdon, J. (2007) *The Disrupters: Lessons for Low-Carbon Innovation From the New Wave of Environmental Pioneers*. National Endowment for Science, Technology and the Arts, London.
- Wilson, E. and Piper, J. (2010) *Spatial Planning and Climate Change*. Routledge, Abingdon.
- Wolf, J., Adger, W. N., Lorenzoni, I., Abrahamson, V. and Raine, R. (2010) Social capital, individual responses to heat waves and climate change adaptation: an empirical study of two UK cities, *Global Environmental Change*, 20: 44–52.

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- Wollmann, H. (2004) Local government reforms in Great Britain, Sweden, Germany and France: between multi-function and single purpose authorities, *Local Government Studies*, 30(4): 639–65.
- World Bank (2010) *Cities and Climate Change: an Urgent Agenda*. World Bank, Washington DC.
- Worldmapper (2012) Greenhouse gases. Online: www.worldmapper.org/display.php?selected=299 (accessed January 2012).
- WWF Hong Kong (2012) Climateers. Online: www.climateers.org/eng/contents/ (accessed January 2012).
- Yardley, J., Sigal, R. J. and Kenny, G. P. (2011) Heat health planning: the importance of social and community factors, *Global Environmental Change*, 21: 670–9.
- Zahran, S., Brody, S. D., Vedlitz, A., Grover, H. and Miller, C. (2008) Vulnerability and capacity: explaining local commitment to climate-change policy, *Environment and Planning C: Government and Policy*, 26: 544–62.
- Zimmerman, R. and Faris, C. (2011) Climate change mitigation and adaptation in North American Cities, *Current Opinion in Environmental Sustainability*, 3: 181–7.