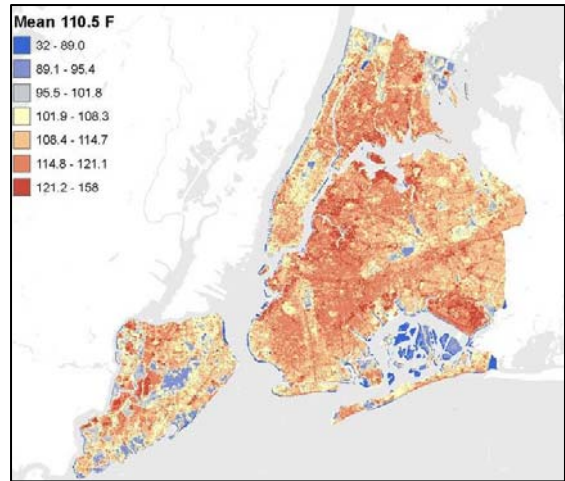
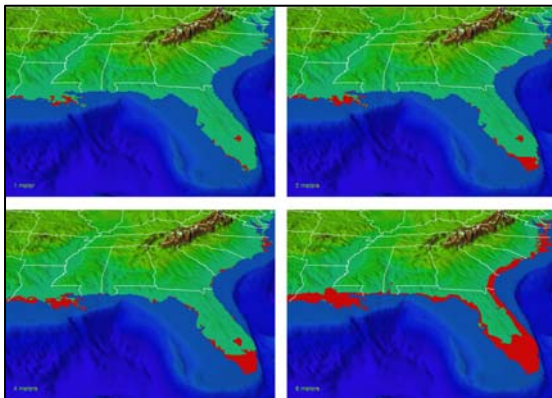




A Survey of Climate Change Adaptation Planning



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Executive Summary

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In the past few years there has been a remarkable increase in the level of awareness of climate change worldwide. Concerns about causes and effects have moved beyond the realm of scientific debate to the offices of legislators and the conference rooms of city planners, and even to the living rooms of people everywhere. As evidence accumulates that a warming planet will cause widespread and mostly harmful effects, scientists and policy makers have proposed various mitigation strategies that might reduce the rate of climate change. For those officials in government who must plan now for an uncertain future, however, strategies for adapting to climate change are equally important.

The options available to planning officials have become better defined over time as they have been studied--and in some cases, implemented--but adaptation planning continues to involve many uncertainties. These arise from the fact that every community is unique in its setting and people, and therefore faces environmental and social vulnerabilities that will differ from those of neighboring communities. Understanding the nature of these vulnerabilities is part of the challenge of creating an adaptation strategy.

Even when the potential threats are understood, the localized nature of impacts and the seemingly distant timeframes involved can make it hard to formulate and implement policies that affect activities taking place in specific localities right now. Fortunately, a number of tools, resources and ongoing efforts are currently available to planners to provide guidance for and examples of adaptation planning.

This introductory survey report is designed to provide a “road map” to some of this information. It makes no claim to be comprehensive or to represent best practices on adaptation. Rather, *the goal in producing this survey is to help generate discussion and the sharing of ideas, efforts and lessons learned across the adaptation community.*

By way of framing the information contained here, the report focuses primarily on Western developed countries, particularly the United States. Additionally, a large urban-area bias will be observed that reflects the availability of these plans at this time and does not reflect the urgent need to develop strategies in less developed regions and in rural areas of the world.

The report is divided into two sections:

- a. Adaptation planning guidebooks and frameworks
- b. Adaptation planning efforts that are currently underway

A wide variety of tools are available to assist in urban adaptation planning. Some of these are geared to the national or even international level and require a great deal in the way of resources and scientific expertise to use. Others have a regional or local focus and, in some cases, are specifically designed to guide local leaders through the bureaucratic

obstacles to effective adaptation planning. For simplicity's sake, all of these resources will be referred to here as "guidebooks and frameworks."

To help planning officials identify which of these resources will be most helpful to them, we developed an eight-step methodology that compares the relative strength of guidebooks and frameworks in the following categories:

- Applicable to different levels of government and types of environmental challenges
- Sufficient detail for policy construction
- Provides decision-making framework
- Includes means to assess such factors as sensitivity, adaptive capacity and vulnerability
- Suggests steps for adaptive actions
- Covers implementation
- Provides links to additional resources
- Includes stakeholders

Using the above methodology, eight guidebooks and frameworks were compared in detail. They are listed below along with a comparative advantage for each:

- a. "Preparing for Climate Change: A Guidebook for Local, Regional and State Governments"
(ICLEI; King County, Washington; Climate Impacts Group, 2007 projected).
Details, step-by-step, the bureaucratic process of constructing and implementing adaptation policy.
- b. "Cities Preparing for Climate Change: A Study of 6 Urban Regions"
(Clean Air Partnership, May 2007).
Incorporates the lessons learned from six "early adopters" and addresses these experiences by phase of the adaptation planning process.
- c. "Adapting to Climate Change: An Introduction for Canadian Municipalities"
(Canadian Climate Impacts and Adaptation Research, February 2006).
Provides six case studies of adaptation programs in Canada from which other communities can glean ideas.
- d. "Surviving Climate Change on Small Islands: A Guidebook"
(Tyndall Centre for Climate Change Research, October 2005).
Contains sections on vulnerability assessment and adaptation plan development as well as an entire chapter on implementation.
- e. "Climate Change Risk and Vulnerability: Promoting an Efficient Adaptation Response in Australia"
(Australian Greenhouse Office, March 2005).
Contains discussions of vulnerability assessments and of decision-making under uncertain conditions, along with a comparative risk assessment framework.
- f. "Coastal Hazards and Climate Change: A Guidance Manual for Local Government in New Zealand"

(New Zealand Climate Change Office, May 2004).

Offers seven principles of management for those facing sea level rise.

- g. “Climate Adaptation: Risk, Uncertainty and Decision-making”

(UK Climate Impacts Programme, May 2003)

Provides an eight-stage decision-making framework to examine and choose among the available adaptation options.

- h. “Handbook on Methods for Climate Change Impact Assessment and Adaptation Strategies”

(United Nations Environment Programme; Institute for Environmental Studies, Vrije Universiteit, Amsterdam; October 1998).

Offers an in-depth look at planning for adaptation in nine different areas of impact.

The second part of the report, adaptation planning efforts, briefly looks at the actions being taken by 18 locations, mostly in the U.S. and Canada. The following four pieces of information are provided for each location:

- A unique or valuable “highlight” from each area
- The current stage of adaptation planning
- The areas of impact and adaptation discussed
- A description of the planning efforts

Each of these 18 locations is listed below along with a highlight of its adaptation planning efforts:

United States

- a. Boston, Massachusetts: The Deer Island Wastewater Treatment Plant was built during the 1990s on higher ground and at higher cost than originally planned to accommodate an anticipated sea-level rise.
- b. Chicago, Illinois: Impact areas being planned for include a projected lake level decrease in Lake Michigan and the impact of higher temperatures on aviation fuel economy.
- c. Fort Collins, Colorado: The head of the city’s Climate Task Force is the director of the municipal utility.
- d. Homer, Alaska: Impact areas being examined include those from ocean acidification and warming oceans.
- e. Keene, New Hampshire: The city’s plan is highly detailed given its population of less than 25,000.
- f. King County, Washington: Part of the county’s plan is to fund climate studies to further refine knowledge of impacts and enhance adaptation efforts.
- g. Los Angeles, California: The city currently is executing a Million Trees L.A. initiative to reduce the urban heat island effect.
- h. Miami-Dade County, Florida: One of the adaptation areas being looked at by the city is a loss of tourism.

- i. New York City, New York: The city has partnered with Columbia University, UPROSE, and the Sunset Park community to “design a standardized process to engage waterfront neighborhoods in conversations about climate change adaptation” by 2008.
- j. Phoenix, Arizona: Water conservation initiatives have resulted in a 20% per-capita drop in water consumption over the last 20 years.
- k. San Francisco Bay: The Bay Area is examining the impacts of climate change on fresh water inflow.

Canada

- a. Quebec: One of the impact areas being examined is the melting of permafrost.
- b. Toronto: In a city-NGO partnership, Toronto worked with the Clean Air Partnership on a four-part project called *Adapting to Climate Change in Toronto*.
- c. Vancouver: Integrated Stormwater Management Plans are being developed to preserve environmental quality and protect communities from localized flooding.

International

- a. Cape Town, South Africa: Downscaled temperature and precipitation data for the area are presented.
- b. London: The adaptation strategy is based on risk management and the idea that adapting to climate change impacts doesn’t involve much that is outside of the normal purview of operations, but simply requires “doing the ordinary better.”
- c. Singapore: All building on coastal land is required to be at a level 40cm higher than the new sea level after an 88cm sea-level rise.
- d. Netherlands: The anticipatory steps being taken for adaptation include the completed construction of a residential floating home test project.

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Introduction

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Developing a climate change policy can be extremely challenging for government officials. Mitigation actions, those that reduce greenhouse gas emissions to prevent future changes in climate, often face opposition because it is hard to see and value the positive impact of local actions that are intended to have a global effect. On the other hand, the fact that these mitigation options are in many ways similar everywhere means there are broad precedents to rely upon. Groups such as ICLEI¹ help local governments to formulate these policies through established frameworks for action.

Adapting to the impacts of climate change, however, poses a different and in some ways more difficult challenge for governments. Global climate change produces impacts that vary dramatically based on location, and a localized analysis and assessment is needed to determine what those impacts may be and how best to deal with them. Even then, it may be hard to implement an action plan when the timeframes of major impacts seem distant or if some adaptation actions seem expensive. These challenges persist even as recent experiences lend a greater sense of urgency to the need for adaptation planning.

While there is a growing amount of material available for government officials and others on how to construct and implement adaptation policies and plans, there is no one resource that provides a “road map” to this information. Our goal in producing this report was to provide just that: an introductory survey of what is available for practical urban adaptation guidance. First, a series of adaptation planning guidebooks and frameworks are examined and compared to allow the user to see which tools each has to offer. Next, the adaptation actions being undertaken by 18 jurisdictions, most of them located in the United States, are briefly examined to enable the sharing of plans, processes and actions on adaptation.

This report is solely intended to be an introductory survey or snapshot. It is not intended to evaluate the guidebooks and adaptation efforts, but rather to compare their content, allowing adaptation planners to quickly find relevant resources for use in their own efforts or studies. The adaptation field is changing and evolving daily, and any attempt at a comprehensive cataloguing of all resources and efforts would be in our view quickly obsolete. This report makes no claim to be exhaustive or to represent best practices on adaptation. Rather, *the goal of producing this survey is to help generate discussion and the sharing of ideas, efforts and lessons learned across the adaptation community.*

Government officials and planners working on adaptation are the target audience for this report, but we believe it will prove useful beyond the government. A broad adaptation community, including those working in NGOs, universities and government, may find

¹ ICLEI, the International Council for Local Environmental Initiatives, was founded in 1990. It is comprised of over 550 cities, towns, counties and their associations worldwide. More information can be found on the organization’s website: <http://www.iclei.org>.

this report a starting point for determining the resources needed, the extent of ongoing efforts, and the extent to which further research is needed. Additionally, this report may be useful to some of the many stakeholders who must be engaged in order to effectively accomplish adaptation efforts, including citizen groups, businesses, and professional associations.

A large-scale urban-area bias is present throughout the second section of the report on planning. This is due in part to the research strategy, which was to begin with areas known to have strong mitigation actions and branch out from there in search of what were thought to be notable or useful adaptation efforts. Inevitably, this approach means that a large number of areas taking action on adaptation planning did not get included in the report, but we are confident that other endeavors or future versions of this report will include those efforts.

As an additional note, the adaptation areas examined here, with only a few exceptions, are all within the United States or other developed Western countries. This is a result of the research method, which began by looking at U.S. areas with existing plans, as well as of the practical necessity of restricting ourselves to source materials available in English. Again, we are hopeful that future reports will address the adaptation efforts being undertaken in other parts of the world, as well as those within the United States that were not examined here.

We hope this report contributes to a sustained effort to facilitate information-sharing across all sectors of the adaptation community. Feedback on the report and suggested additions for possible future editions are welcome. Comments can be forwarded to: adaptation@heinzctr.org.

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A Survey of Adaptation Planning Guidebooks and Frameworks

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Introduction

Designing and implementing an adaptation policy can pose several challenges for government officials. By its very nature, adaptation is a local effort, since the projected impacts from climate change can differ greatly even over small geographic areas. Planning officials need to understand these local impacts in detail before they can decide on the best responses. A variety of techniques are available to help, including “downscaling” from GCM² data, which requires time, expertise and resources, as well as analyses of probable climate change impacts under different scenarios.

Once the potential impacts are understood, officials can begin building an adaptation strategy. Each piece of the strategy should be backed with an analysis of the benefits and costs of the options considered, especially for those requiring large investments of money and other resources. A successful plan also requires the involvement of a broad range of stakeholders throughout the entire process, from scoping the problem to implementation. The participation of government officials, businesses, civic groups and the general public can help generate ideas as well as build consensus and support for an adaptation plan. Some of these stakeholders may nonetheless resist taking action or supporting the broader plan, especially if they perceive the major impacts to be far in the future or uncertain to occur, or if the proposed adaptation actions will be expensive. To educate and engage the public, officials may emphasize the impacts that can already be seen, the uncertainties involved, the importance of taking action as a precaution against the worst impacts, and the potential fringe benefits of an adaptation plan in the way of opportunities for social and economic development.

These challenges can be daunting even to experts in the adaptation field, but they may seem especially overwhelming to a government official who, in some cases, is tasked to put together such a plan on a part-time basis in addition to his or her other duties. Many tools and resources exist, however, which can greatly help to simplify and guide officials through the adaptation planning process. Although they vary widely in purpose and content, they will be referred to here as guidebooks and frameworks.³ These resources

² General Circulation Models (GCMs). These are the large-scale computer simulations run to predict what will happen to the Earth’s climate over time. However, because of computing power and data constraints, the spatial resolution in the GCMs, beyond which no more detail can be discerned, can be hundreds of kilometers wide. Various techniques are available for “downscaling,” allowing this data output from the GCM predictions to be sharpened for greater resolution at the local level.

³ A wide variety of resources for adaptation planning are available. These include guides for action, adaptation frameworks, case studies, urban adaptation analyses, histories of progress, etc. Some of the resources examined in this section span one or more of these categories and others. However, for simplicity’s sake the broad catch-all of “guidebooks and frameworks” was used for this comparison section.

help guide adaptation planning by providing an outline of needed actions or steps in the process and sharing best practices or lessons learned from others. These tools range from those applicable at the national level requiring a great deal in the way of resources and scientific expertise to use effectively, to those geared toward the local level and designed to guide local officials through the obstacles to successful adaptation planning.

Methodology

The available guidebooks and frameworks for adaptation planning vary greatly in terms of their comprehensiveness, intended audience, and purpose, making it difficult to compare them objectively. Therefore, to choose which detailed resources to evaluate and compare, we considered what resources would be useful to a policymaker or government official who wants to plan for climate change adaptation at the state, regional, or municipal level. Eight qualitative comparison criteria were selected:

1. Applicable to different levels of government and types of environmental challenges. Adaptation is distinctly regional and local, and the challenges faced by climate change impacts can vary dramatically over even small regions. The variation can be due to differences in the actual climatic changes, infrastructure constraints, existing environmental conditions, and community reliance on ecosystem services such as the protective effect of wetlands in coastal areas. Thus, guidebooks or frameworks are most useful to a broad range of constituencies when applicable to widely varying adaptation challenges. Additionally, since a small county will likely have fewer resources than a state, more general guidance means that its basic method and ideas can be used at any level of government and with whatever resources are available.
2. Sufficient detail for policy construction. Does the resource cover the entire process, from scoping the problem to implementing policy, in both the scientific or more theoretical arena (e.g., vulnerability assessment) and the practical (involving stakeholders most effectively)?
3. Provides a decision-making framework. This is an intentionally broad criterion. It looks for tools provided which will help government officials evaluate options, decide when adaptation actions should be implemented, and measure their costs and benefits, etc. In essence, it looks for some method which policymakers can use to logically and effectively guide decision-making.
4. Includes means to assess such factors as sensitivity, adaptive capacity, and vulnerability. As noted above, adaptation is a highly localized endeavor, and the findings of broad regional climate change impact studies are often “downscaled” or tailored to determine local impacts. Factors such as adaptive capacity are important for determining overall vulnerability and thus for making adaptation decisions. To this end, a resource has additional utility if it provides a way for government officials to conceptualize and address these factors in a more than purely qualitative way. Additionally, many resources suggest a “path back to science,” that is to scientific experts who can consult and assist in incorporating climate science into adaptation decisions. The scientific path also lets scientists know what additional research would be helpful in decision-making.

5. Suggests steps for adaptive actions. Although adaptation is a localized issue, many areas will face similar problems and can benefit from knowledge of adaptation actions that have been applied successfully elsewhere. An ideal resource will thus provide ideas, case studies or successful practices from the adaptation efforts of other areas.
6. Covers implementation. As any policymaker understands, even the most well-crafted policy can fail if not implemented properly. This is particularly true of adaptation policy, given the numerous stakeholders and often sweeping mandates involved. Ideally a resource will discuss how to best implement and enforce adaptation policy to ensure effectiveness.
7. Links to additional resources provided. No matter how comprehensive an adaptation policy resource is, local officials need to know where to go for follow-on research on climate science and impacts, policies, etc. to address specific areas of concern. An ideal resource provides a detailed, easy-to-use reference list for these resources.
8. Includes stakeholders. Two vital characteristics of adaptation policymaking are the transparency and equity of the process. A transparent process allows all selected participants and the public to understand how decisions are being made, and helps to ensure that the outcome is equitable for all. Including as many groups as possible in the decision-making process is a way to help achieve both of these. An ideal resource emphasizes the importance of incorporating stakeholders into different stages of the adaptation process, suggests ways to accomplish this, and discusses how to enhance participation.

In the charts beginning on page 15, each of the guidebooks and frameworks is evaluated based on the eight selected criteria. Check marks on a scale of zero to two are used in the charts as follows:



discussed in depth



discussed in some detail

none

very little detail or not discussed

While this system is simple and, to some degree, subjective, it offers a starting point from which to examine each guidebook or framework in greater detail.

Results

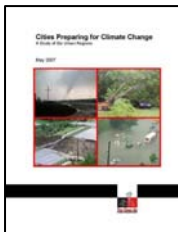
In searching the adaptation field for resources, tools that appeared most likely to be useful to government officials on the ground engaged in adaptation planning were selected. This report concentrates on U.S. and Western-centric reports written in English. We began by examining areas with existing mitigation efforts, sought advice from those working in the adaptation field, and searched the Internet, maintaining a focus on locating practical tools for major urban areas.

Of the resources identified, an objective examination with an emphasis on practicality led to the selection of the following eight guidebooks and frameworks for a more detailed analysis. They are presented here in chronological order of their publication date (with the most recent first).



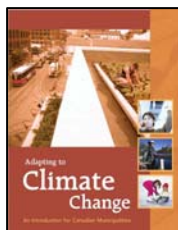
“Preparing for Climate Change: A Guidebook for Local, Regional and State Governments”

*Climate Impacts Group (University of Washington); ICLEI; King County, Washington; funded by NOAA. (Initiated by a 2005 conference)⁴
September 2007 *Note: Only the draft report was reviewed**



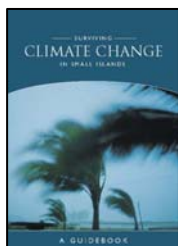
“Cities Preparing for Climate Change: A Study of 6 Urban Regions”

*Clean Air Partnership (Toronto, Canada)
May 2007*



“Adapting to Climate Change: An Introduction for Canadian Municipalities”

*Canadian Climate Impacts and Adaptation Research Network
February 2006*



“Surviving Climate Change on Small Islands: A Guidebook”

*Tyndall Centre for Climate Change Research (Norwich, UK)
October 2005 (Image courtesy Tyndall Centre via Asher Minns)*

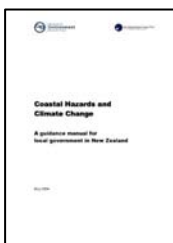
⁴ King County held a conference in October 2005 entitled “King County Climate Change: The Future Ain’t What It Used to Be.” Sponsored by a large number of organizations, this conference spurred the creation of the guidebook.



“Climate Change Risk and Vulnerability: Promoting an Efficient Adaptation Response in Australia”

Australian Greenhouse Office

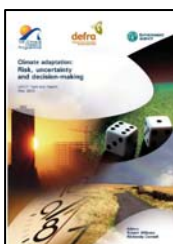
March 2005



“Coastal Hazards and Climate Change: A Guidance Manual for Local Government in New Zealand”

New Zealand Climate Change Office

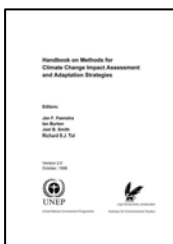
May 2004



“Climate Adaptation: Risk, Uncertainty and Decision-making”

UK Climate Impacts Programme Technical Report (Oxford, UK)

May 2003



“Handbook on Methods for Climate Change Impact Assessment and Adaptation Strategies”

United Nations Environment Programme; Institute for Environmental Studies, Vrije Universiteit, Amsterdam

October 1998

The broad overview chart on page 15 displays the results of applying the criteria described above to the eight guidebooks and frameworks surveyed. The chart reveals there is no “perfect” guidebook or framework among those examined. However, each has its own unique focus areas, reflecting the differing objectives, experiences and perspectives of those who produced it. Following the overview chart is an individual chart for each guidebook or framework, addressing each of the eight methodological questions in greater detail.

Comparison Criteria

<i>Applicable to different levels of government and types of environmental challenges</i>	✓✓	✓✓	✓	✓	✓	✓	✓	✓✓	✓	
<i>Sufficient detail for policy construction</i>	✓✓			✓	✓	✓	✓			
<i>Provides a decision-making framework</i>	✓	✓		✓	✓✓	✓✓	✓✓	✓✓	✓✓	
<i>Includes means to assess sensitivity, adaptive capacity, vulnerability</i>	✓		✓	✓	✓✓	✓✓			✓✓	
<i>Suggests steps for adaptive actions</i>	✓✓	✓✓	✓✓	✓	✓	✓✓			✓✓	
<i>Covers implementation</i>	✓	✓		✓✓		✓✓	✓		✓	
<i>Provides links to additional resources</i>	✓✓		✓	✓✓		✓	✓✓			
<i>Includes stakeholders</i>	✓✓	✓✓	✓✓	✓✓	✓	✓	✓✓		✓	

Legend:



discussed in depth



discussed in some detail

none -- very little detail or not discussed

Comparison Criteria	  	“Preparing for Climate Change: A Guidebook for Local, Regional and State Governments” (September 2007)
<i>Applicable to different levels of government and types of environmental challenges</i>	✓✓	The guidebook was designed specifically for local and regional governments. Indeed, the strategies and techniques discussed can be readily used at any level of government in any area of the world.
<i>Sufficient detail for policy construction</i>	✓✓	In most ways, absolutely yes. It also goes into great detail in certain areas that are vague or nonexistent in other guides. For example, sections such as “Build and Maintain Support to Plan for Climate Change” and “Create a Climate Change Adaptation Team,” with sub-sections covering topics such as when and why to form a team, who should lead the team, who should be on the team, etc. are especially helpful to the government official on the ground trying to start the process of adaptation planning and policymaking.
<i>Provides a decision-making framework</i>	✓	Chapter 5 covers how to identify priority sectors for adaptation planning based on consequences and likelihood of impacts, community attitude toward different risks, etc. Additionally, Chapter 6, “Plan for Climate Change,” includes methods for identifying, evaluating and selecting adaptation strategies.
<i>Includes means to assess sensitivity, adaptive capacity, vulnerability</i>	✓	The guidebook includes a non-quantitative framework for assessing vulnerability. This includes the sub-steps of a) basic information gathering, b) assessing sensitivities, c) assessing adaptability, and d) assessing vulnerability.
<i>Suggests steps for adaptive actions</i>	✓✓	Yes. It includes a table of possible adaptive strategies for the Pacific Northwest in eight categories. Examples of Chicago and NYC adaptation measures are also included.
<i>Covers implementation</i>	✓	The section on actual implementation is limited, but there is a good amount of material on “defining success and updating plans.”
<i>Provides links to additional resources</i>	✓✓	Yes, fairly extensive. Links are provided to institutional information on climate change, climate change science, and information on impacts and adaptation down to the local level.
<i>Includes stakeholders</i>	✓✓	Yes. The guide discusses the need for stakeholder involvement at all stages of the adaptation planning and implementation process.

Legend: ✓✓ discussed in depth ✓ discussed in some detail none -- very little detail or not discussed

Comparison Criteria		“Cities Preparing for Climate Change: A Study of 6 Urban Regions” (2007)
<i>Applicable to different levels of government and types of environmental challenges</i>	✓✓	Although the report is tailored to the city and urban region level, the general framework discussed, and particularly the lessons learned, are broadly applicable to higher levels of government. The lessons also apply to a wide variety of environmental challenges.
<i>Sufficient detail for policy construction</i>		The report is much more of a high-level process- and case study-oriented overview and is not a detailed step-by-step “how to” book.
<i>Provides a decision-making framework</i>	✓	The report includes both an adaptation process framework and several excellent examples of risk assessments.
<i>Includes means to assess sensitivity, adaptive capacity, vulnerability</i>		No. It offers case studies of cities conducting climate impact assessments, but includes no “how to.”
<i>Suggests steps for adaptive actions</i>	✓✓	Yes, a relatively large number along with some anecdotal examples and best practices.
<i>Covers implementation</i>	✓	The report identifies some sources of support for and obstacles to implementation, drawn from the six-city case study.
<i>Provides links to additional resources</i>		The study lists the reports produced by the six case study cities, as well as other reports, but it does not provide a “further information” section.
<i>Includes stakeholders</i>	✓✓	Yes, stakeholders are a very important part of the framework set forth in the report. Sections are provided on raising awareness of stakeholders to the problem as well as engaging stakeholders. Stakeholders are part of the entire process from policy construction to implementation in this framework.

Legend: ✓✓ discussed in depth ✓ discussed in some detail none -- very little detail or not discussed

Comparison Criteria	 “Adapting to Climate Change: An Introduction for Canadian Municipalities” (2006)	
<i>Applicable to different levels of government and types of environmental challenges</i>		Yes. Although it is tailored for municipalities, the information presented could be used at different levels of government.
<i>Sufficient detail for policy construction</i>		No. As the title implies, this is an “introduction” for communities on adapting to climate change and does not include enough detail to serve as a framework for adaptation.
<i>Provides decision-making framework</i>		No, although it is discussed briefly in some of the case studies.
<i>Includes means to assess sensitivity, adaptive capacity, vulnerability</i>		Five broad steps outline how to conduct a vulnerability assessment.
<i>Suggests steps for adaptive actions</i>		Yes. In fact, the body of the paper consists largely of six case studies in adaptation. The localities covered include Toronto, Vancouver, Halifax, Sept-Îles, Iqaluit, and Annapolis.
<i>Covers implementation</i>		No.
<i>Provides links to additional resources</i>		Very limited. Contacts are provided for the six case studies, and a single page of resources is provided.
<i>Includes stakeholders</i>		Yes, in the section describing vulnerability assessment as well as in the case studies.

Legend:  discussed in depth  discussed in some detail none -- very little detail or not discussed

Comparison Criteria	 “Surviving Climate Change on Small Islands: A Guidebook” (2005)	
<i>Applicable to different levels of government and types of environmental challenges</i>	✓	The handbook is tailored to island threats, such as sea-level rise and storms. However, the sections on vulnerability assessment, adaptation plan development and implementation are broadly applicable and useful for policymakers outside of island nations.
<i>Sufficient detail for policy construction</i>	✓	In some ways, yes. It maps out the different steps to follow in constructing and implementing an adaptation plan. However, it does not include a specific “how-to” guide. There are no quantitative measures or frameworks of any kind included.
<i>Provides a decision-making framework</i>	✓	Not really; it is discussed briefly. However, the guidebook does provide an adaptation strategy framework with eight elements.
<i>Includes means to assess sensitivity, adaptive capacity, vulnerability</i>	✓	The guidebook offers a framework (WEHAB+) for looking at vulnerability. However, it does not provide a way to measure other factors such as resilience, adaptive capacity, etc.
<i>Suggests steps for adaptive actions</i>	✓	Yes, a limited number of examples are given. Some links are also provided in the “further information” section.
<i>Covers implementation</i>	✓✓	Yes, an entire chapter is devoted to implementation.
<i>Provides links to additional resources</i>	✓✓	The guidebook includes many links to other resources for further information.
<i>Includes stakeholders</i>	✓✓	Yes. Both the development and implementation chapters discuss the integration of stakeholders.

Legend: ✓✓ discussed in depth ✓ discussed in some detail none -- very little detail or not discussed

Comparison Criteria	 Australian Government Australian Greenhouse Office	“Climate Change Risk and Vulnerability: Promoting an Efficient Adaptation Response in Australia” (2005)
<i>Applicable to different levels of government and types of environmental challenges</i>		Although select and more theoretical parts of the report could be broadly applied, it is written specifically for Australia, and even contains climate vulnerability studies of seven regions within Australia judged to be critical. It also contains bureaucratic details, etc. that are Australia-specific, so the applicability of the study outside of Australia is quite limited. It could, however, serve as a useful template for similar studies elsewhere.
<i>Sufficient detail for policy construction</i>		In certain ways. The report is intended to be a high-level assessment of the most vulnerable systems and sectors in Australia. It includes tools for risk assessment and decision-making.
<i>Provides a decision-making framework</i>		The report offers techniques for decision-making under uncertainty, techniques for vulnerability analysis, and a comparative risk assessment framework (consisting of climate exposure, system sensitivity, adaptive capacity, adverse implications and potential to benefit).
<i>Includes means to assess sensitivity, adaptive capacity, vulnerability</i>		Yes. In particular, the report determines exposure, sensitivity, and adaptive capacity, which together determine vulnerability. This framework is then applied to a number of climate pressures on industry, the natural environment and health and infrastructure, as well as each of the seven regions studied in the report.
<i>Suggests steps for adaptive actions</i>		Extremely limited; a handful of broad examples are mentioned in the report.
<i>Covers implementation</i>		No.
<i>Provides links to additional resources</i>		Footnotes and bibliography only; no “additional references” section.
<i>Includes stakeholders</i>		Stakeholder concerns and interests are expressed throughout the document.

Legend:  discussed in depth  discussed in some detail none -- very little detail or not discussed

Comparison Criteria	 New Zealand Climate Change Office Te Tari Rauemi Mātanga Ahuaroangi o Aotearoa	“Coastal Hazards and Climate Change: A Guidance Manual for Local Government in New Zealand” (2004)
<i>Applicable to different levels of government and types of environmental challenges</i>		The manual is written specifically for coastal communities, but the risk assessment process and risk-based decision-making framework can be applied universally. However, the seven detailed principles of management options provided in the report are written specifically for coastal areas.
<i>Sufficient detail for policy construction</i>		Yes, in terms of the technical aspects of risk assessment, weighing policy options, etc. However, the manual provides little information to navigate through the government bureaucracy (in contrast to the ICLEI manual). It does not address, for example, forming a climate team, holding meetings, etc. But the book is also just what it claims to be: a <i>guidance</i> manual.
<i>Provides a decision-making framework</i>		Yes, the manual provides a risk-based decision-making framework. It also includes a detailed risk assessment process (with an entire accompanying chapter).
<i>Includes means to assess sensitivity, adaptive capacity, vulnerability</i>		The manual contains an entire chapter exploring in detail the risk assessment and evaluation process, including a quantitative measure and model.
<i>Suggests steps for adaptive actions</i>		Yes, it offers many broad sample steps.
<i>Covers implementation</i>		The manual sets out seven principles of management options and gives each its own implementation section. The principles are: know coastal risks, avoid new development in hazard areas, locate new development to minimize future losses, new building design, protect existing development from losses, take precaution in locating and designing infrastructure, and plan for evacuation.
<i>Provides links to additional resources</i>		Yes, but only a few websites are provided.
<i>Includes stakeholders</i>		Stakeholders are mentioned in the sections devoted to problem definition, evaluation of risk management options, and response strategy.

Legend:  discussed in depth  discussed in some detail none -- very little detail or not discussed

Comparison Criteria		“Climate Adaptation: Risk, Uncertainty and Decision-making” (2003)
<i>Applicable to different levels of government and types of environmental challenges</i>	✓✓	The framework is extremely broad, so that it can be used by any level of government.
<i>Sufficient detail for policy construction</i>	✓	The report is <i>extremely</i> technically detailed on the decision-making framework, including risk assessment. However, it is not intended to be a “guidebook” for policymakers. It does not offer guidance on implementation or the bureaucratic hurdles and considerations that arise in constructing and implementing climate policy. This is a very focused guide designed to complement such an approach and give strength and analytical rigor to the decision-making process.
<i>Provides a decision-making framework</i>	✓✓	Yes. An eight-stage decision-making framework is the core of the report. The stated objective of the report is “to provide guidance that helps decision-makers and their advisors a) take account of the risk and uncertainty associated with climate variability and future climate change and b) identify and appraise measures to mitigate the impact or exploit the opportunities presented by future climate – that is, to identify good adaptation options.”
<i>Includes means to assess sensitivity, adaptive capacity, vulnerability</i>		Such assessments are not dealt with directly in the report, although they are mentioned and integrated into the overall basis of the decision-making framework. A section entitled “Key aspects of climate change risk assessment” defines these terms and discusses generally how to incorporate them into decision-making.
<i>Suggests steps for adaptive actions</i>		No, except for a very limited forestry case study given in an Appendix.
<i>Covers implementation</i>	✓	The timing of implementation is discussed.
<i>Provides links to additional resources</i>	✓✓	Yes, the report includes six pages of websites with information, tools and software on both climate change and risk assessment.
<i>Includes stakeholders</i>	✓✓	Yes, the importance of including stakeholders is stressed at all stages of the decision-making process laid out in the eight-step framework.

Legend: ✓✓ discussed in depth ✓ discussed in some detail none -- very little detail or not discussed

Comparison Criteria	 UNEP	“Handbook on Methods for Climate Change Impact Assessment and Adaptation Strategies” (1999)
<i>Applicable to different levels of government and types of environmental challenges</i>	✓	The report was designed specifically to aid the development of Climate Change Country Studies. The resources required for such detailed modeling and analysis probably preclude it from being applied at anything below a state level.
<i>Sufficient detail for policy construction</i>		No; it is a technical paper meant for rigorous modeling and analysis of climate change impact assessment and adaptation strategies. As such, it does not discuss in detail any of the steps required to create or implement an adaptation plan.
<i>Provides a decision-making framework</i>	✓✓	It includes a discussion and matrix of different methods that can be used to assess potential adaptation measures, e.g. benefit-cost and cost-effectiveness analyses.
<i>Includes means to assess sensitivity, adaptive capacity, vulnerability</i>	✓✓	The handbook includes a fairly comprehensive look at socio-economic scenarios, climate change scenarios, integrated assessments, and the theory and assessment of adaptation. It also outlines methods of vulnerability assessment.
<i>Suggests steps for adaptive actions</i>	✓✓	Yes; broad level sample adaptation actions are listed briefly for each of the nine sectors examined in the report (water resources, coastal zones, agriculture, rangeland and livestock, human health, energy, forest, biodiversity and fisheries).
<i>Covers implementation</i>	✓	The handbook includes implementation as a factor in assessing adaptation measures, but does not discuss implementation itself.
<i>Provides links to additional resources</i>		Extensive lists of references follow each section but are not collected at the end. In addition, the references are generally quite technical.
<i>Includes stakeholders</i>	✓	The importance of engaging and soliciting judgments and assistance from stakeholders is emphasized throughout.

Legend: ✓✓ discussed in depth ✓ discussed in some detail none -- very little detail or not discussed

Additional Guidebook in Progress

An additional project recently began that promises to be a valuable addition to the literature. Scott Shuford, a career urban planner who most recently served in Asheville, North Carolina, is writing “Planning for Climate Change: A Handbook for City, Town and Rural Area Planners.” Scott feels that the vast majority of urban planners are not tying their work into climate change, and that a lack of information is a major contributor to the problem. He intends to produce a “practical” and “implementable” guide, informed by climate data, which will contain region-specific information for planners. It will seek to balance mitigation and adaptation planning aspects, and will cover the following areas: land use, transportation, natural resources management, structure and site design, public safety, public infrastructure, economic development, and social services. The handbook is projected to be published in the spring or early summer of 2008 and is being sponsored by NOAA’s National Climatic Data Center and the Environmental Quality Institute at the University of North Carolina in Asheville. For more information contact [Scott Shuford](#).

Comparative Advantages

The guidebooks and frameworks examined here offer a diversity of approaches, and there is no “best” resource. Each, however, has its own unique focus areas and strengths.

An actual “how-to” book for taking adaptation from the theoretical stage through implementation, including the bureaucratic aspects, is found in “Preparing for Climate Change” (ICLEI, CIG, King County). Lessons learned from the process in King County were incorporated into this guide, whereas other resources examined rarely included this kind of information.

The Clean Air Partnership’s “Cities Preparing for Climate Change” report is valuable because it incorporates the lessons learned from six “early adapters” and addresses their experiences by phase of the adaptation planning process. The final section of the report, “Lessons from Early Adapters,” identifies a number of important sources of support for and obstacles to adaptation action from the areas examined.

The C-CIARN study, “Adapting to Climate Change,” provides an overview of the need for adaptation in Canada and provides six case studies of Canadian adaptation programs from which other communities can glean ideas.

The Tyndall Centre report, “Surviving Climate Change on Small Islands,” will be of great value to island planners or those on the coasts facing sea-level rise, and is also important for its sections on vulnerability assessment and adaptation plan development. Additionally, it contains an entire chapter on implementation – an area often overlooked.

The Australian Greenhouse Office’s “Climate Change Risk and Vulnerability” contains discussions of decision-making under uncertain conditions along with its comparative risk assessment framework.

The New Zealand manual, “Coastal Hazards and Climate Change,” is a resource on adapting to sea-level rise, with its seven principles of management options. It also includes a unique quantitative risk assessment evaluation model.

The eight-stage decision-making framework of the UK Climate Impacts Programme’s “Climate Adaptation: Risk, Uncertainty and Decision-making” provides a useful means of rigorously examining and choosing among the available adaptation options.

A strength of the UNEP “Handbook on Methods,” in addition to its look at adaptation measure assessment methods, is its in-depth look at planning for adaptation in nine different sectors (a full chapter is devoted to each sector).

An anticipated benefit of Scott Shuford’s upcoming handbook is that it proposes to be designed specifically for urban planners.

Adaptation Guidance and Collaboration Initiatives

Two initiatives recently launched to assist urban areas in adaptation planning:

[Urban Leaders Adaptation Initiative on Infrastructure, Land Use and Climate Change](#)
(Center for Clean Air Policy)

This program was launched in December 2006 and is aimed at ensuring the resilience of partner and participant communities in the face of climate change. The six partner communities to date are: King County, Washington; Los Angeles; Miami-Dade County; Milwaukee; Nassau County; and San Francisco. Participants have included Boston, Chicago, Houston and Toronto. The presentations from the December 2006 meetings and two webinars (May and June 2007) are available online along with a comprehensive list of adaptation resources.⁵ The program plans to release a white paper in November 2007 discussing urban adaptation concerns, opportunities and solutions, as well as opportunities for the Federal government to support local adaptation efforts. Additionally, they will be hosting the next Urban Leaders meeting in fall 2007. For more information, visit their [website](#) or contact [Steve Winkelman](#).

⁵ Presentations: <http://www.ccap.org/domestic/ULI.htm>. Resource list: <http://www.ccap.org/domestic/ULI/Resource%20List.doc>.

Climate Resilient Communities (ICLEI)

An ICLEI pilot program sponsored by NOAA funding, Climate Resilient Communities (CRC) is a “network designed to help local governments develop their capacity to identify and reduce vulnerabilities from the threat of climate change.”⁶ Some of the ways the program does this are by linking local governments with NOAA Regional Integrated Sciences and Assessments (RISA)⁷ offices for available climate science as well as by helping with identifying opportunities for increasing resiliency and developing an adaptation action plan. The CRC program helps cities to use a five-milestone process for adaptation planning: 1) study and assess climate resilience, 2) set goals and prioritize, 3) develop an action plan, 4) implement the action plan, and 5) monitor efforts and re-evaluate the plan. Four CRC pilot communities are currently going through this process: Fort Collins, Colorado; Homer, Alaska; Keene, New Hampshire; and Miami-Dade County, Florida. For more information visit their [website](#) or contact [Margit Hentschel](#).

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⁶ Josh Foster, webinar presentation to Center for Clean Policy – Urban Leaders Initiative, 12 June 2007. <http://www.ccap.org/domestic/ULI/Josh%20Foster%20for%20CCAP-ULI%206-12-07.pdf>

⁷ Through eight regional teams, the NOAA Regional Integrated Sciences and Assessments (RISA) Program “supports research that addresses complex climate sensitive issues of concern to decision-makers and policy planners at a regional level.” http://www.climate.noaa.gov/cpo_pa/risa/

A Survey of Adaptation Planning

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Introduction

The localized nature of adaptation planning means that people working in the adaptation field often remain unaware of the efforts underway elsewhere, and miss the opportunity to learn from what others are doing. The following brief survey of ongoing adaptation planning efforts expands this discussion. This snapshot of some ongoing adaptation efforts is not intended to be comprehensive or to represent best practices. Rather, it provides the broader adaptation community with examples of what is currently happening, both to increase awareness and to enable the sharing of lessons learned. As discussed in the report introduction, there exists both a Western-developed-country and large-scale-urban-area bias to the efforts examined here. The examples of adaptation planning discussed, however, can be valuable in many other places.

Methodology

Both because adaptation is inherently a localized endeavor and because the ongoing (and rapidly increasing number of) adaptation efforts around the world are so diverse, this report does not evaluate and compare the efforts reviewed. Instead, a basic set of information is presented for each of the efforts surveyed:

- A unique or valuable “highlight” from each area
- The current stage of adaptation planning
- Areas of impact and adaptation discussed⁸
- A description of the adaptation planning effort, focusing on actions or areas which are either unique among the cities surveyed or may be of value for other planners

All the impact and adaptation areas listed have been indexed and hyperlinked between each area’s listing and the “Index of Impacts,” which is the final section in this chapter. The original labels of the impact or adaptation area used by a location to describe its efforts were retained but where necessary, some standardization was applied to avoid redundant terms in the index. In places where a term different than the original is used to index, the area’s term is listed first with the standardized term following in parentheses and hyperlinked. As a final note, some efforts are discussed in greater detail than others. This is a function of our initial efforts to extract and communicate helpful ideas rather than a reflection of the underlying strength or weakness of adaptation planning in the area discussed.

⁸ Some areas framed actions or programs in terms of “sustainability” rather than adaptation. An attempt was made to include in the report “sustainability” efforts that also have a strong adaptation benefit.

This survey looks at the following 18 locations, shown on the map below, in which adaptation planning is ongoing:

United States

[Boston, Massachusetts](#)

[Chicago, Illinois](#)

[Fort Collins, Colorado](#)

[Homer, Alaska](#)

[Keene, New Hampshire](#)

[King County, Washington](#)

[Los Angeles, California](#)

[Miami-Dade County, Florida](#)

[New York City, New York](#)

[Phoenix, Arizona](#)

[San Francisco Bay](#)

Canada

[Quebec](#)

[Toronto](#)

[Vancouver](#)

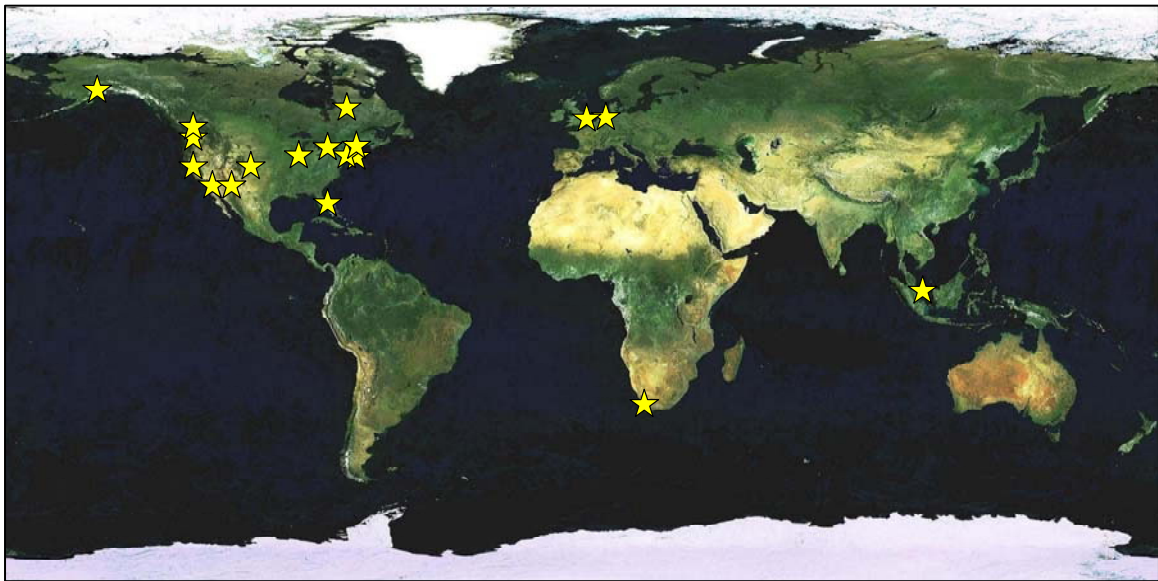
International

[Cape Town, South Africa](#)

[London](#)

[Singapore](#)

[Netherlands](#)



Background image courtesy of Orbithangar

Adaptation Efforts

United States

Boston, Massachusetts

Highlight: An example of climate impacts integration that has already occurred is the Deer Island Wastewater Treatment Plant, which was built during the 1990s at a higher elevation and higher cost than originally planned to accommodate an anticipated sea-level rise.⁹

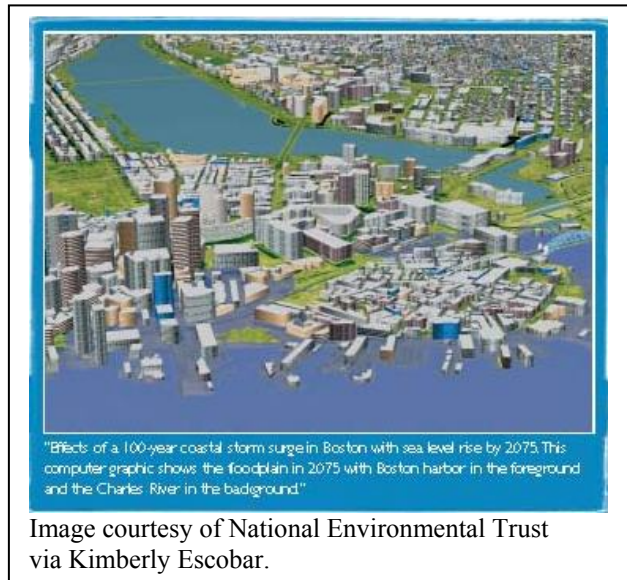
Stage of plan: preliminary

Areas of impact / adaptation

discussed: [bridge scour](#),¹⁰ energy use ([energy demand](#)), [public health](#), [flooding](#), [sea-level rise](#), [buildings](#),¹¹ [transportation](#), [water quality](#), [water supply](#)

Description: In August 2004, the CLIMB report was released, which details anticipated climate impacts to Boston in the above areas and recommended adaptation options. Mayor Thomas Menino issued an executive order in April 2007 that contained two major adaptation provisions. First, Boston will prepare an integrated adaptation plan that will both outline actions to reduce risks from likely climate impacts and coordinate “those actions with the city’s plans for emergency response, homeland security, natural hazard mitigation, neighborhood planning and economic development.” Second, the order states that planning for all new construction and major renovations of municipal facilities will evaluate the risks posed by climate change through 2050 and “describe potential steps to avoid, minimize or mitigate those risks.” The city is in the process of putting these directives into effect. Currently, climate change impacts are considered for large private projects through reviews conducted by the Boston Redevelopment Authority.

Sources: [Carl Spector](#), City of Boston; [Executive Order](#); [CLIMB report](#)



⁹ Clean Air Partnership, “Cities Preparing for Climate Change: A Study of 6 Urban Regions.” Page 54.

¹⁰ Bridge scour refers to the potential increased erosion of bridge foundations due to increased flood discharges in rivers. “Climate’s Long-Term Impacts on Metro Boston (CLIMB),” August 13, 2004: http://www.net.org/reports/climb_fullreport.pdf. Page 156.

¹¹ In particular, Boston is looking at the impacts on “tall buildings,” and this refers to building damage from potential increased wind speeds due to climate change. Ibid., p. 156.

Chicago, Illinois

Highlight: Several impacts being planned for include a projected lake-level decrease in Lake Michigan and the effects of higher temperatures on aviation fuel economy.

Stage of plan: Preliminary

Areas of impact / adaptation discussed: [aviation](#),¹² [buildings](#), [energy demand](#), [lake level decrease](#), [public health](#), [transportation](#), [water supply](#)

Description: Chicago is currently in the process of developing a comprehensive climate action plan, due to be completed in the fall of 2007, with both mitigation and adaptation components. The adaptation portion of the plan will include an assessment of the likely impacts of climate change along with prescriptive adaptation actions, and is predicted by the Chicago Department of Environment to be one of the most aggressive in the country. Several research projects will feed into the report, including a University of Illinois project using downscaling from GCM data to predict the likely climate impacts on the city, and a risk assessment examining action vs. non-action.

Source: Mike Johnson, Chicago Department of Environment



Fort Collins, Colorado

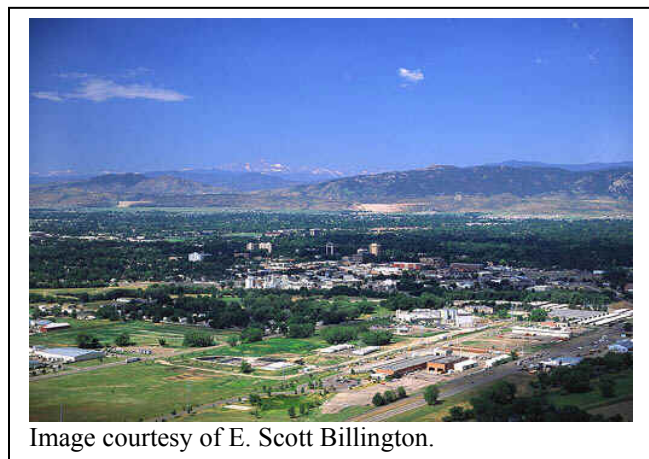
Highlight: The head of the city's Climate Task Force is the director of the municipal utility.

Stage of plan: preliminary

Areas of impact / adaptation discussed: projected to include [flooding](#), water resources ([water supply](#))

Description: Fort Collins is one of the four pilot cities for the ICLEI [Climate Resilient Communities](#) program. A Climate Task Force has

been formed and began working on adaptation in August of 2007, with an anticipated timeframe of the end of the year for producing an adaptation plan. Since a significant adaptation challenge in the region is managing water resources, the city has appointed as head of the Climate Task Force the director of Fort Collins Water Utilities, the municipal utility company which provides electric, sewer and water. The tenth anniversary of a severe flood, which killed five people, has provided impetus to the need for adaptation planning.



¹² As temperature rises, aviation fuel vaporizes more quickly, thus decreasing the fuel efficiency of aircraft.

Source: [Lucinda Smith](#), City of Fort Collins; [Press release](#); for further information contact [Patty Bigner](#), Fort Collins Water Utilities

Homer, Alaska

Highlight: Several impacts being examined are those from ocean acidification and warming oceans.

Stage of plan: preliminary
Areas of impact / adaptation discussed: tentatively the impacts from [extreme weather events](#), [ocean acidification](#), [sea-level rise](#), [warming oceans](#), [water supply](#) disruption and wildfire risks ([fires](#)) will be discussed

Description: Homer is one of the pilot cities for the ICLEI [Climate Resilient Communities](#) program. The city has founded a Global Warming Task Force to produce a climate action plan including both mitigation and adaptation, with a goal of completion by the end of 2007. Three tentative overarching adaptation goals will be addressed: creating a resilient local economy, protecting existing infrastructure, and adopting wise policies for future development.

Source: [Anne Marie Holen](#), City of Homer

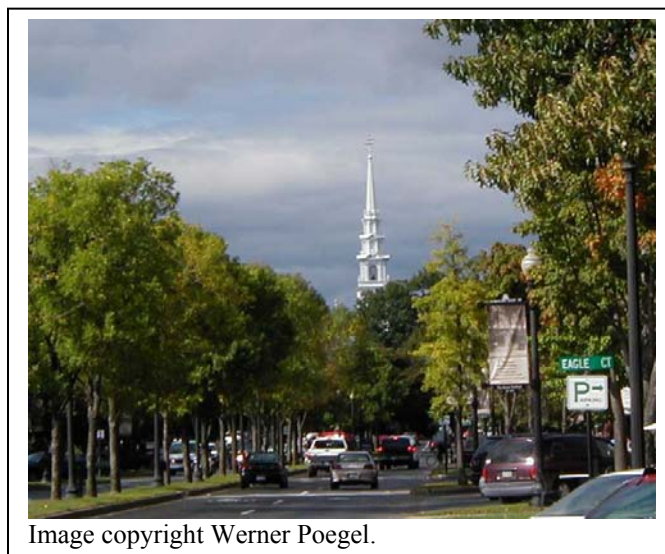


Keene, New Hampshire

Highlight: The city's plan is extremely detailed given its small population of less than 25,000.

Stage of plan: draft
Areas of impact / adaptation discussed: The impacts were divided into three sectors: the built environment ([buildings](#), [communication infrastructure](#), open space resources ([land use](#)), [transportation](#) infrastructure, the natural environment (fauna, flora, ([biodiversity and ecosystems](#)), [food supply](#), [wetlands](#)), and the social environment ([economy](#), [emergency services](#), [public health](#)).

Description: Keene is one of the four pilot cities for the ICLEI [Climate Resilient Communities](#) program. Based on a review of climate science and the expected climate



impacts in the Northeast, a committee comprised of local government officials and staff, community members, and university and health field representatives determined Keene's climate vulnerabilities in great detail (the vulnerability section of the draft report spans eight pages). The committee then prioritized these vulnerabilities to identify the city's areas of focus in order to increase community climate resiliency. The prioritization process was democratic. After identifying the climate vulnerabilities, each committee member ranked each one against a set of criteria. The cumulative results identified the top five climate vulnerabilities within each of the three sectors – which served as a starting point for the group. These were then formulated into goals to increase community climate resiliency. The committee then identified measurable targets to achieve each adaptation goal.

One of the major recommendations in the report is to incorporate relevant portions of this plan into the city's comprehensive master planning process, which will allow for a detailed community discussion about sustainability. The plan also recommends that the city redirect energy savings into a fund to hire a full-time Sustainability Coordinator for the city. Several lessons learned from the process are also given in the conclusion: set up a regular meeting schedule for the committee charged with assisting development of the plan. Establish a relationship with a climate scientist and ensure regular attendance at the meetings, and create tangible ranking criteria to allow enough time for the committee to rank and prioritize actions.

The Keene plan is striking and exemplary in its detail considering the relatively small population, around 23,000 in 2005.¹³ As a side note, no actual downscaling from GCM models was performed for this plan. A mixture of impacts studied by the Union of Concerned Scientists and national and regional studies was combined with anecdotal evidence to determine the city's most relevant climate impacts.

Source: Mikaela Engert, City of Keene

King County, Washington

Highlight: Part of the county's adaptation plan is to fund climate studies to further refine knowledge of impacts and enhance adaptation efforts.

Stage of plan: The adaptation plan is part of a published comprehensive climate action plan comprising both mitigation and adaptation strategies.

Areas of impact / adaptation

discussed: [biodiversity and ecosystems](#); [climate science](#); [economic](#) impacts; [land use](#), [buildings](#) and [transportation](#); [public health](#), safety ([safety and human security](#)), and emergency preparedness



¹³ <http://www.nh.gov/oep/programs/DataCenter/Population/PopulationEstimates.htm>.

([emergency services](#)); [surface water management](#), freshwater quality ([water quality](#)), and [water supply](#)

Description: The adaptation plan is comprehensive, spanning 39 pages in the report. It contains detailed strategies for each focus area, but is not a “technical” plan per se. It explicitly directs that the relevant departments for each area are responsible for devising the tactical implementation of the strategies and goals put forth. Additionally, it is intended to be revised over time as circumstances and resources change.

Source: [2007 King County Climate Plan](#)

Los Angeles, California

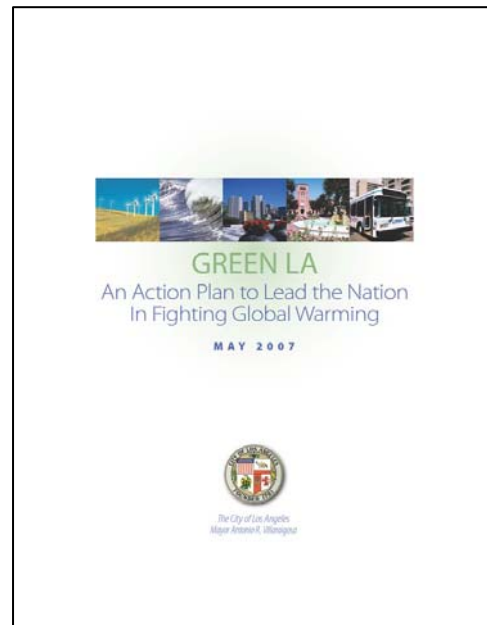
Highlight: The city is currently executing a Million Trees L.A. initiative to reduce the urban heat island effect.

Stage of plan: Adaptation is a very small part (less than 1 page) of the city’s climate change action plan.

Areas of impact / adaptation discussed: [buildings](#), [education](#), [heat islands](#)

Description: Very little is said about adaptation in the climate action plan. However, one of the points made is that a comprehensive adaptation plan needs to be developed for the city to deal with impacts such as drought, wildfires, sea-level rise, and public health impacts. The Million Trees L.A. initiative, to reduce the urban heat island effect, is highlighted.

Source: [Green LA plan](#)



Miami-Dade County, Florida

Highlight: One of the adaptation areas being looked at by the city is a loss of tourism.

Stage of plan: preliminary; a task force has been formed to examine the issue and make recommendations

Areas of impact / adaptation discussed:

Among the impacts to be addressed are [agricultural and fisheries](#), [sea-level rise](#), drinking [water supply](#), [flooding](#), health impacts ([public health](#)), [temperature increases](#), infectious diseases ([public health](#)), loss of coastal [wetlands](#), and [loss of tourism](#).



Image courtesy of stock.xchng

Description: Miami-Dade is one of the four pilot areas for the ICLEI [Climate Resilient Communities](#) program. To date, the recently-formed Climate Change Advisory Task Force (CCATF) has held a number of meetings and formed six subcommittees on: i) scientific and technical issues ii) greenhouse gas reduction iii) natural systems adaptation iv) property and infrastructure adaptation v) economic, social and health issues and vi) intergovernmental affairs. The CCATF expects to have preliminary recommendations completed by the end of 2007.

Source: [Derek Bradchulis](#), Miami-Dade County; [Presentation](#).

New York City, New York

Highlight: To address community-specific planning efforts, the city has partnered with Columbia University, United Puerto Rican Organization of Sunset Park (UPROSE), and the Sunset Park community to “design a standardized process to engage waterfront neighborhoods in conversations about climate change adaptation” by 2008.¹⁴



Stage of plan: Developing adaptation measures included in citywide sustainability plan

Areas of impact / adaptation discussed: [air quality](#), [flooding](#), heat waves ([temperature increases](#)), [sea-level rise](#), [heat islands](#)

Description: Three main strategies are laid out in the plan for adapting to climate change: i) create an intergovernmental Task Force to protect the city’s vital infrastructure, ii) work with vulnerable neighborhoods to develop site-specific strategies and iii) launch a city-wide strategic planning process for climate change adaptation. The city’s Climate Change Task Force, founded in 2004 by the Department of Environmental Quality (DEP), has worked with Columbia University and NASA to use global and regional climate models to aid in planning and investment in sewer and wastewater treatment systems affected by sea-level rise and storm surges. In the future, the Task Force will examine the impacts on other infrastructure, such as the subways, airports and power plants, and will invite other stakeholder agencies such as the MTA, Port Authority and utilities to participate. The city also plans to create a New York City Climate Change Advisory Board, composed of non-city government agencies, scientists, engineers, insurance experts, and public policy experts, to: i) develop a risk-based, cost-benefit assessment process to inform investment decisions, and ii) assess and provide recommendations on possible strategies to protect against flooding and storm surges. Other explicit actions called for in the report include updating the city’s 100-year floodplain maps, documenting floodplain management strategies to secure discounted flood insurance for residents, and amending the building code to address the impacts of climate change. Source: [Plan NYC 2030](#)

¹⁴ NYC 2030 plan, p. 138.

Phoenix, Arizona

Highlight: The city's water conservation initiatives have resulted in a 20% per-capita drop in water consumption over the last 20 years.

Stage of plan: Sustainability report complete. In fall 2007, the city will begin constructing a comprehensive climate action plan, which will include adaptation components.

Areas of impact / adaptation

discussed: [buildings](#), [energy demand](#), [energy supply](#), [heat islands](#), [water demand](#), [water supply](#)

Description: Many programs with adaptation components are built into the Phoenix General Plan, and these are outlined in the city's 74-point Sustainability Program Summary. These include: i) a task force and collaboration with Arizona State University to study urban heat island mitigation, ii) a Landfill Gas to Energy Project to provide a renewable fuel resource, iii) numerous energy conservation programs, iv) green building and energy-efficient housing programs, v) a long-term water resource sustainability plan, and vi) water conservation initiatives that have resulted in a 20% drop in per-capita water consumption over the last 20 years.

Source: [Gaye Knight](#), City of Phoenix; [Phoenix sustainability program](#)



San Francisco Bay, California

Highlight: The Bay Area is examining the impacts of climate change on fresh water inflow.

Stage of plan: The San Francisco Bay Conservation and Development Commission (BCDC) has approved a preliminary climate change action plan.

Areas of impact / adaptation discussed: [flooding](#), [fresh water inflow](#), increased storm activity ([extreme weather events](#)), [sea-level rise](#)

Description: Using sea-level rise maps, the BCDC has calculated that a one-meter increase in sea level around the Bay could flood over 200 square miles of land and threaten with inundation over



Image courtesy of San Francisco BCDC*.

\$100 billion of development.¹⁵ In July 2007, the Commission approved an introductory climate change action plan that includes seeking greater funding for impact studies and building partnerships with other agencies to produce effective regional response to and planning for impacts.

**Image note: Map is based on 10m DEM and 2m DSM USGS and National Agriculture Imagery Program data. Map is illustrative and depicts a potential inundation scenario by 2100. Limitations in the geospatial data available may effect accuracy. Map should not be used for planning purposes.*

Source: [San Francisco BCDC climate action plan, plan approval meeting minutes](#)

Canada

Province of Quebec, Canada

Highlight: One of the impact areas being examined is the melting of permafrost.

Stage of plan: Complete. Approximately 4 pages of the 40-page 2006-2012 climate action plan are dedicated to adaptation.

Areas of impact / adaptation discussed: health ([public health](#)); environment, natural resources, and the territory ([air quality](#), [permafrost melting](#), and water resources ([water supply](#))); [forestry](#)

Description: Although some of the adaptation measures discussed are already underway, many of the goals listed for adaptation require studies or projections to be carried out in order to more precisely determine both the impacts and an optimal adaptation strategy. The adaptation section of Quebec's plan can be seen as a starting point for adaptation in that it recognizes the potential impacts, dealing through the precautionary principle with those that are known, and planning to study and address those that are more uncertain.

Source: [Quebec climate action plan](#)



Toronto, Canada

Highlight: In a city-NGO partnership, Toronto worked with the Clean Air Partnership on a four-part project called *Adapting to Climate Change in Toronto*.

Stage of plan: The city is currently in the process of writing a comprehensive adaptation plan.



¹⁵ "Recommendations on a Climate Change Action Plan," San Francisco Bay Conservation and Development Commission website, dated 6 July 2007.

<http://www.bcdc.ca.gov/index.php?p=610&more=1&c=1&tb=1&pb=1>.

Areas of impact / adaptation discussed: droughts ([water supply](#)), [flooding](#), health ([public health](#)) and [economic](#) impacts, heat waves ([temperature increases](#))

Description: The framework for public engagement released in March 2007 recognized the need for development of a comprehensive adaptation plan, which is now being constructed. As noted in the framework, vulnerability scans of city operations will be conducted to identify potential climate change impacts.

Source: [Toronto framework for engagement](#); [Jennifer Penney](#), The Clean Air Partnership

Vancouver, Canada

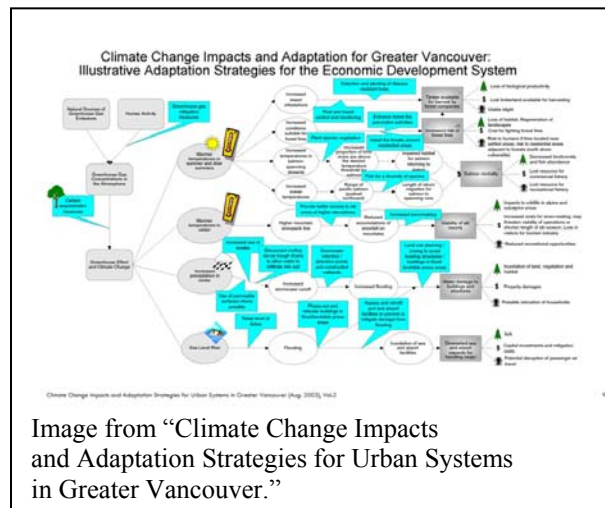
Highlight: Integrated Stormwater Management Plans are being developed to preserve environmental quality and protect communities from localized flooding.

Stage of plan: introductory analysis

Areas of impact / adaptation discussed: [agriculture](#) and food ([food supply](#)), [air quality](#), [buildings](#), [culture](#), [economic](#) development, energy ([energy demand](#), [energy supply](#)), [flooding](#), [forestry](#), health and well-being ([public health](#)), [human security](#), [land use](#), mobility ([transportation](#)), natural habitat ([biodiversity and ecosystems](#)), [social equity](#), and water ([water demand](#), [water quality](#), [water supply](#))

Description: The report is relatively general and is composed in large part of influence diagrams of impacts and potential mitigation measures for the areas described above. The need for adaptation in Vancouver is discussed and an 11-part framework of “adaptation general implementation considerations and strategies” is presented as well. An important ongoing program is the creation of Integrated Stormwater Management Plans (ISMPs), spurred by increased precipitation in the region. The ISMPs are watershed-specific, flexible and adaptive strategies that have as their goal to “result in no net loss to environmental quality and protect communities from localized flooding.”¹⁶ A template for the ISMPs has been created, and, through a stakeholder-intensive process, all municipalities of the Greater Vancouver Regional District will implement ISMPs in their urban watersheds by 2014. Although not driven by concerns about climate change impacts, this program is unique because it demonstrates how adaptation can be incorporated into existing planning efforts.

Source: [Vancouver impacts and adaptation strategy documents](#); [C-CIARN report](#)



¹⁶ Canadian Climate Impacts Adaptation and Research Network (C-CIARN), “Adapting to Climate Change: An Introduction for Canadian Municipalities,” p. 17.

International

Cape Town, South Africa

Highlight: Downscaled temperature and precipitation data for the area is presented.



Image courtesy of Andres de Wet.

Stage of plan: Underway. A framework for adaptation has been produced.

Areas of impact / adaptation discussed: [biodiversity](#), coastal zones ([sea-level rise](#)), [fire](#) management, health ([public health](#)), livelihoods, stormwater management ([flooding](#)), urban water supplies ([water supply](#))

Description: A process is outlined for producing a city adaptation plan of action. Each of the impact areas discussed above has a section outlining the impacts/vulnerabilities and adaptation initiatives in that area.

Source: [Cape Town framework for adaptation](#)

London, United Kingdom

Highlight: The adaptation strategy is based on risk management, and the idea that adapting to climate change impacts doesn't involve much that is outside of the normal purview of operations, but simply requires "doing the ordinary better."

Stage of plan: In draft phase. First draft for London Assembly review will be released in August 2007, with a draft for public review released following that, and a final draft projected for February 2008.

Areas of impact / adaptation discussed: Major focus areas are drought ([water supply](#)), [flooding](#), and [temperature increases](#); also [air quality](#), [economic](#), winter storm severity ([extreme weather events](#)), [transportation](#)

Description: The groundwork for the adaptation plan has been laid through several previously-released reports, including "London's Warming" (2002), "Climate Change and London's Transport Systems" (2005), and "Adapting to Climate Change: Lessons for London" (2006). The adaptation strategy for London will be a mayoral strategy which will seek to "mainstream" climate issues through the Greater London Authority. Flooding, drought and temperature increases are the main focus of the strategy, but other impacts such as air quality and winter storm severity will be addressed as well. An additional focus of the report will be climate change events that occur outside of London



Image courtesy of freefoto.com.

itself, but have impacts in the city because it serves as the country's financial center. With such factors as a large portion of the world's insurance markets situated in London, a high Bangladeshi population, and dependence on timely importation of manufacturing goods, impacts across the world will be keenly felt in the city.

Source: [Alex Nickson](#), Greater London Authority.

Singapore

Highlight: All building on coastal land is required to be at a level 40cm higher than the new sea level after an 88cm sea-level rise.

Stage of plan: Preliminary

Areas of impact / adaptation discussed: higher [energy demand](#) and heat stress ([temperature increases](#)), island and marine [biodiversity](#), land loss ([sea-level rise](#)) and [flooding](#), [public health](#), water resources ([water supply](#))

Description: A preliminary listing of the potential impacts and a small amount of detail on each one is listed on the government webpage. It states that the government is commissioning studies to better determine the impacts and allow planning of adaptation measures.

Source: [Singapore climate strategy website](#)



Image courtesy of Aleksandar Vacić.

Netherlands

Highlight: The anticipatory steps being taken for adaptation include the completed construction of a residential floating home test project.

Stage of plan: Analysis

Areas of impact / adaptation discussed: [flooding](#), [sea-level rise](#)

Description: Dutch researchers are analyzing the impacts of sea-level rise on their dyke system, which was built to withstand flood probabilities calculated around 1960. Some options being examined are strengthening dykes, restricting development and building floating homes.

Source: [Technology Review](#)

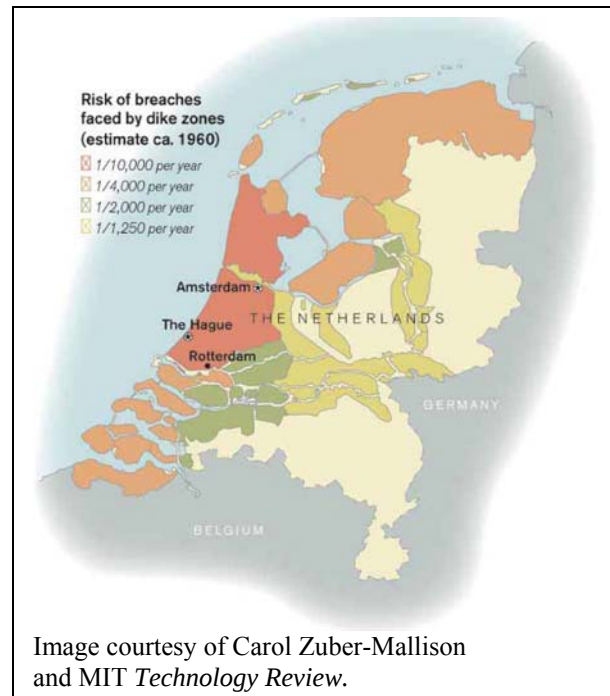


Image courtesy of Carol Zuber-Mallison and MIT Technology Review.

Index of Impacts

The following index arranges the city plans discussed above by the areas of impact and adaptation. This is intended to help find examples of locations that are conducting adaptation planning in certain areas. Note that a lack of mention in this listing does not mean a location is not doing adaptation planning in a certain area, but only that any such planning effort was not discussed in this report.

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Conclusion

The adaptation and climate change fields continue to expand rapidly. The scientific understanding of climatic change projections and the associated impacts from these changes, as well as our understanding of the vulnerabilities faced by human societies and structures, will continue to evolve over time. In the same way, procedures and techniques for planning for and adapting to these impacts and addressing vulnerabilities will continue to become more effective over time. Preparing for these impacts through adaptation planning becomes a continual process, to be regularly revisited and refined as impacts, vulnerabilities and strategies become better defined. This report provides an initial overview of strategies under development and offers insights into the methodology of their development.

Urban planners in the adaptation field will find no shortage of information and resources offering practical guidance in their work. This report sorts through some of the available guidebooks, handbooks, and collaboration initiatives to assist planning officials in finding the information most relevant to their own efforts. Brief snapshots are provided of ongoing adaptation efforts in 18 locations that may offer useful lessons. By making this information more accessible, we hope to help local officials plan and implement their own adaptation strategies more efficiently and with greater support and acceptance from the stakeholders in their communities.

Finally, this survey report encourages further dialogue and information-sharing within the adaptation community. We envision this communication occurring between sectors, including government, academia and environmental organizations, as well as within each of those sectors (e.g. the sharing between local governments of lessons learned from adaptation efforts). Possible projects to result from this effort may include future editions of the report or a website portal with a “dynamic” and constantly evolving version of the survey.

Please send feedback and suggestions to adaptation@heinzctr.org.

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Appendix: References and Suggested Adaptation Resources

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Examined Guidebooks and Frameworks

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<http://data.ukcip.org.uk/resources/publications/documents/4.pdf>. (requires registration)

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<http://www.greenhouse.gov.au/impacts/publications/pubs/risk-vulnerability.pdf>.

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Fort Collins, Colorado: Lucinda Smith, Senior Environmental Planner, Fort Collins, lsmith@fcgov.com. Contact for further information: Patty Bigner, Customer Connections Manager, Fort Collins Water Utilities, pbigner@fcgov.com. Press release, 14 June 2007.

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Images

All report cover images are courtesy of the organization that produced the report. Front cover images on this report are credited on page 3. All other images are credited in the text under the image.

Adaptation Resources

ADAM Project (Adaptation and Mitigation Strategies: supporting European climate policy)

<http://www.adamproject.eu/>

Adaptation Network

<http://www.adaptationnetwork.org/>

American Planning Association (writing policy guide on planning and global warming)

<http://www.planning.org/>

Assessments of Impacts and Adaptations to Climate Change in Multiple Regions and Sectors

<http://www.aiaccproject.org/>

Center for Clean Air Policy – Urban Leaders Adaptation Initiative

<http://www.ccap.org/domestic/ULI.htm>

Center for Clean Air Policy – Urban Leaders Adaptation Initiative Resource List

<http://www.ccap.org/domestic/ULI/Resource%20List.doc>

Clean Air Partnership

<http://www.cleanairpartnership.org/>

Climate Change Information Resources – New York City

<http://ccir.ciesin.columbia.edu/nyc/index.html>

Environmental Protection Agency – Adaptation

<http://www.epa.gov/climatechange/effects/adaptation.html>

European Union – Living with Climate Change in Europe

http://ec.europa.eu/environment/climat/adaptation/index_en.htm

International Council for Local Environmental Initiatives (ICLEI)

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NOAA Climate Program Office

http://www.climate.noaa.gov/cpo_pa/

NOAA Regional Integrated Sciences and Assessments (RISA) Program

http://www.climate.noaa.gov/cpo_pa/risa/

Pew Center on Global Climate Change

<http://pewclimate.org>

Pew Center State Action Maps

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Tyndall Centre for Climate Change Research

<http://www.tyndall.ac.uk/>

UK Climate Impacts Programme

<http://www.ukcip.org.uk/>

UK Climate Impacts Programme Adaptation Actions Database

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UK Town and Country Planning Association

<http://www.tcpa.org.uk/>

U.S. Global Change Research Program – “Climate Change Impacts on the United States”

<http://www.usgcrp.gov/usgcrp/Library/nationalassessment/foundation.htm>

Adaptation Networks

AdaptNet

<http://gc.nautilus.org/gci/adaptnet>

Capacity Strengthening of Least Developed Countries (LDCs) for Adaptation to Climate Change (CLACC)

<http://www.clacc.net/>

Community Based Adaptation Exchange (part of Linking Climate Adaptation, below)

<http://www.cba-exchange.org/>

Knowledge Network on Vulnerability and Adaptation to Climate Change Resource Centre

<http://ncsp.va-network.org/section/resources>

Linking Climate Adaptation Network

<http://www.linkingclimateadaptation.org/>

Urban Climate Change Research Network (UCCRN)

<http://www.uccrn.org/>

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Authors

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