Climate Adaptation & Resilience
A Resource Guide for Local Leaders
Version 2.0

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and
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Acknowledgements

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The ISC team that researched, wrote and reviewed this guide included Steve Adams, Nathaly Agosto Filiar, Michael Crowley, Josh Kelly and Rebecca Webber. Steve Adams was the project manager. Simeon Chapin designed the guide and accompanying materials.

In researching and producing the Resource Guide, ISC consulted with the 12 participating workshop teams, Resource Team members, as well as a wide range of leading experts and practitioners. ISC wishes to thank the many individuals and organizations that contributed their knowledge and expertise.

About the Institute for Sustainable Communities

Since its founding in 1991 by former Vermont Governor Madeleine Kunin, ISC has led 80 transformative, community-driven projects in 24 countries. ISC specializes in developing and delivering highly successful training and technical assistance programs that improve the effectiveness of communities, their leaders, and the institutions that support them. In April of 2012, ISC launched the Sustainable Communities Leadership Academy website to make the valuable, high caliber information from our first-class peer-learning and training workshops available to practitioners in any community.

We welcome your feedback!

This Resource Guide is a work-in-progress. It will be maintained as a web-based resource and updated to provide valuable resources to public, private and nonprofit sector leaders working to promote resilience-building activities across North America. If you have comments on the guide, or ideas for how to improve it, please send them to Steve Adams at the Institute for Sustainable Communities at sadams@iscvt.org.

This Resource Guide was printed on 100% recycled paper.
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Introduction and Overview

The Challenge

In the two years since the Institute for Sustainable Communities (ISC) first published a Resource Guide on Climate Adaptation & Resilience, extreme weather events have continued to occur on a global scale. The 2010 Pakistani flood and extreme heat/drought event that affected the greater Moscow region documented in that first Resource Guide were followed by 2011, a year in which the U.S. experienced 14 extreme weather events that exceeded $1B in total damage.1 Closer to home, every state in the lower 48 except Vermont experienced summer highs in excess of 100°F as the summer of 2011 became the second hottest on record. While linking specific weather events to climate change remains challenging, climatology “attribution” for extreme weather events is advancing and increasingly demonstrating very solid connections. And these connections are starting to be reported for a general public readership.2

One could argue that 2011 and 2012 may well be remembered as the point at which the "average American" at last understood climatic scale impacts in the form of extreme weather events. The drought conditions that gripped a record number of counties by mid-summer were literally the worst experienced since the Dust Bowl years of the 1930s. The heat wave and drought event of 2012 affected over 80 million people across the U.S. according to the National Oceanic and Atmospheric Administration (NOAA), 10 million more than were affected in 2011. July 2012 set the record as the hottest July and the hottest month ever observed since records began in 1895. The summer of 2011 and the summer of 2012 are second and third behind the summer of 1936.

Given the growing frequency of such events, it comes as no surprise that climate change adaptation is rapidly moving up the policy agenda for many local governments, even as the lingering fiscal strain of the Great Recession continues to pinch local budgets. This emphasis on climate change adaptation is a marked departure from the policy priorities of the last decade when climate change

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mitigation dominated discussion at every level of government. For many reasons, this emphasis on mitigation over adaptation has flipped utterly and some local government officials indicate that they are challenged to keep climate mitigation issues on the agenda.

Following the Intergovernmental Panel on Climate Change, “climate adaptation” as used here means “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.” Climate change “mitigation” as used here means an action designed “to reduce the sources or enhance the sinks of greenhouse gases” associated with global climate change. It should be noted that emergency management professionals tend to use the term “mitigation” differently – meaning “any cost-effective action taken to eliminate or reduce the long-term risk to life and property from natural and technological hazards.” Climate change adaptation (rather than climate mitigation) is more similar to hazard mitigation in practice, techniques and desired outcomes.

The State of Climate Change Adaptation Policy & Practice

Efforts are now under way in industry and at every level of government to incorporate adaptive responses into existing climate change initiatives. These efforts are driven by a growing body of evidence documenting rapid change in natural systems worldwide as well as the realization that climatic impacts are occurring and will continue to occur even with the most aggressive global emission reductions imaginable. The current state of the field within the U.S. benefits from the work of many practitioners, analysts, and pioneer communities that began work on climate adaptation. While the U.S. generally lags international efforts on climate adaptation, there is a rapidly growing community of practice among public sector practitioners, researchers and private and nonprofit service providers.

Within the public sector, federal climate adaptation activities are highly diffuse with nominal coordination occurring through the Council on Environmental Quality Interagency Task Force on Climate Change Adaptation which to date has enacted guidance to agencies requiring the inclusion of adaptation considerations into agency sustainability plans and the coordination of three cross-cutting federal strategies for coastal and marine resources, freshwater resources, and fish, wildlife and plants management. Agencies charged with managing federal assets such as national parks, forests and rangelands, and military installations are increasingly active in assessing climate risks to those assets and developing appropriate adaptation strategies. Agencies that interact with state and

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3 http://www.whitehouse.gov/administration/eop/ceq/initiatives/adaptation
4 Guidance released March 2011
5 Released January 2012 as a component of the National Oceans Policy
6 Released October 2011
7 Released January 2012
local government have begun to assess the impact of federal policy and funding guidance to local adaptation imperatives (e.g., FEMA’s National Flood Insurance Program & Pre-Disaster Hazard Mitigation Planning Guidance), but the primary role that federal agencies seek to play in state and local climate adaptation activities centers on the provision of technical assistance (e.g. NOAA Coastal Zone Act grants, Federal Highway Administration transit assessment grants) and “climate services” in the form of regional climate science products for local decision-makers via the NOAA Regional Integrated Science & Assessment (RISA) program and the Department of Interior’s Regional Climate Centers. The current National Climate Assessment, mandated by the Global Change Research Act of 1990, is attempting to transition toward a more dynamic, ongoing assessment process that continuously serves decision makers rather than the periodic, and somewhat ad hoc, reporting function that has been the case in the past.

State government activity on climate adaptation has lagged within the last few years with focused assessment and planning activities occurring mainly on the West Coast (CA, OR, WA), Maryland, and in New England (CT, MA). Several states initiated climate adaptation initiatives in conjunction with or as follow-on activities to state climate mitigation plans that were common across the country in advance of the 111th Congress of 2009-10, but many of those early efforts were abandoned or left unimplemented following a significant turnover among governors and state legislatures in the 2010 mid-term election. Only California, Maryland and Massachusetts have shown significant climate adaptation effort since the 2010 election. Other states (Oregon and Washington) have published adaptation plans, but severe fiscal stress appears to preclude even modest implementation in the near future.

Local government efforts on climate adaptation lead the country in terms of the volume of work, the extent of the issues addressed, and the generation of innovative public policy mechanisms and techniques. The Georgetown Center for State & Federal Climate Change Policy Adaptation Clearinghouse contains entries for 24 comprehensive local government climate adaptation plans while the EcoAdapt’s Climate Adaptation Knowledge Exchange (CAKEx) portal contains listings for another dozen. Joanne Carmin of MIT, in a 2011 survey of the full global membership of ICLEI local governments, found that 68% of ICLEI members worldwide were active in some form on the issue of climate change adaptation. Within the U.S., 59% of the 298 ICLEI member communities that responded to Professor Carmin’s survey were pursuing climate change adaptation initiatives.

Beyond these local government climate adaptation plans, other local governments have begun to incorporate climate adaptation considerations into other local planning processes such as transportation, land use, and infrastructure capital projects. The diversity of these plans and their lack of billing as “climate adaptation” activities make it difficult to track their extent across local governments.

To better understand the state of climate adaptation practice in cities, and the challenges that cities are facing, ISC consulted with several nationally recognized organizations and nearly 50 practitioners from the 16 U.S. cities that participated in the 2010 leadership academy. Follow-up assessments of the field since that initial event suggest that the growing body of applied policy and practice has advanced climate adaptation beyond its early focus on methodological concerns—the “how” of organizing, initiating and implementing climate adaptation strategies. A set of “big questions” facing the field as it continues to develop:
Adaptation Framing: How are the imperatives of climate adaptation framed for the general public and decision makers? How does “resilience” relate to “climate preparedness” or “adaptation”? How do each of these relate to “sustainability”?

Adaptation Mainstreaming: To what extent should climate adaptation be embedded within existing planning and management processes? What does successful wholesale incorporation of climate adaptation look like from the perspective of other disciplines such as disaster risk reduction, infrastructure planning and development, and land use planning?

Adaptation Governance: What is the appropriate scale for various approaches to adaptation planning and strategy development? What approaches enable multi-sectoral collaboration (to manage trade-offs and synergies) and multi-jurisdictional collaboration (both horizontal across equivalent adjoining jurisdictions and vertical across local-state/provincial-national-international governments)? What mechanisms enable long-term initiatives to flourish beyond the terms in office of particular elected officials?

Toward an Adaptive Culture: What are the internal mechanisms, skill sets, and performance incentives within institutions and organizations that enable “adaptive management” over time? How do we foster these skill sets, support those working in the adaptation space, and foster opportunities for networking, peer learning and mutual social support?

Adaptation beyond Public Sector Planning: The field to date is dominated by the vulnerability assessment, planning and implementation idiom; what are the incentives and drivers that would appropriately facilitate autonomous adaptation within the public and private sectors? What are the primary existing barriers that preclude autonomous adaptation and whose interests do they serve?

Adaptation Decision Support: How should policy makers assess alternative adaptation strategies on the margin? How can one characterize risk abated? What degree of specificity within regional model downscaling is sufficient for “investment grade” decision support?

Adaptation Monitoring & Evaluation: What does successful adaptation look like? How can adaptation practitioners and the public officials they serve measure progress toward “resilience”?

Practitioners’ Key Challenges
The interviews that ISC conducted with the twelve teams selected for the 2nd National CLA provided further evidence supporting the remaining validity of the “big questions” in 2012, but also indicated a set of common challenges in strengthening climate resilience:

Methods Still Matter: While many local government adaptation initiatives have advanced quite far, a growing number of new participants in existing initiatives and a growing number of new initiatives are providing ample demand for guidance documents and case studies documenting the “how-to” aspects of local climate adaptation planning.

Communications Remains a Challenge: Nearly all practitioners said that they needed help in persuading colleagues, elected officials, and residents to take action on climate resilience.
Collaborations are Difficult but Necessary: City practitioners may face added levels of complexity in working on climate change adaptation because managing climate risks involves numerous agencies, some of which may operate outside the city’s purview. Several agencies, for example, may share responsibility for the operation of a city’s transportation network. Often the resilience of one part of the system relies on the way climate risks are managed across the entire system. A city’s resilience may also be affected by the climate preparedness of private utilities, telecommunications firms, and shipping companies. Some climate risks, such as drought, require regional cooperation so as to account for water resource management throughout the watershed.

Integration or “Mainstreaming” of Adaptation is the Path for Action: Even practitioners who work in cities that are relatively advanced in climate adaptation planning asserted that the integration of climate concerns into planning and operations was difficult. “Everything must change,” as one practitioner put it, so that urban and transportation planning, environmental review processes, related laws and regulations, and engineering standards account for climate risk information.

Economic Evaluation of Adaptation Measures is Difficult: Evaluating the risks of climate impacts and the benefits of adaptation measures also presents a challenge to some practitioners. The difficulty stems from the complexity of the climate impacts, including their uncertainty and their tendency to intensify over time. More dynamic cost-benefit models than the ones that are typically used for project financing may be necessary to help practitioners make better-informed adaptation decisions.

Learning is a Key Feature of a Resilient Organization: Cities that are implementing adaptation strategies are struggling to develop ways to measure the extent to which they are increasing climate resilience. These cities recognize that being better at learning, managing uncertainty, taking calculated risks, and assessing results are all attributes in which any organization that seeks to thrive in rapidly changing conditions must excel.

About this Resource Guide
This Resource Guide represents a synthesis of information selected for the practitioners participating in our 2nd National Climate Leadership Academy on Adaptation & Resilience. The Resource Guide is intended to help practitioners in cities and metropolitan areas resolve local issues, by showcasing promising practices in climate adaptation and resilience, and by providing efficient access to some of the very best information and resources available.

The Resource Guide is not an exhaustive compilation of available information—a near-impossible task given the growing volume of international studies, reports, websites, books and blogs on the topic of climate resilience. Still, this document reflects an effort to identify, compile, vet and synthesize useful information on innovative policies, programs and practices being deployed throughout the country.
The Resource Guide includes:

- Case Studies that discuss how various local government practitioners have made progress on climate adaptation planning, including risk assessment and integrating of climate concerns in planning.
- Resource lists that direct practitioners toward the topic-specific sources of information—studies, reports, articles, and websites—that we believe are most likely to help them improve, expand and accelerate their adaptation and resilience efforts.

Finally, this Resource Guide is and will continue to be a work in progress. While ISC produced it initially for those practitioners attending the 2nd National Climate Leadership Academy on Adaptation & Resilience, we intend to update and expand it on a regular basis, and make it available to local practitioners everywhere.
Case Studies
The following case studies, snapshots and emerging issue briefs have been prepared for the practitioners participating in the Second National Climate Leadership Academy on Adaptation & Resilience. Reflecting the themes that developed over the course of participant interviews, the case studies are presented in one of five thematic areas:

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Models for Adaptation Planning

In the first ISC Resource Guide on Adaptation & Resilience, staff prepared case studies documenting the processes used by practitioners from the City of Chicago, Miami-Dade County, and the City of New York in developing climate change adaptation plans at the community scale. The full case studies are available on ISC’s Sustainable Communities Leadership Academy website. This synopsis captures in brief the lessons learned as previously documented.

The Chicago Climate Action Plan

Creating the Plan, Preparing for Change. The Chicago Climate Action Plan process was divided into three phases leading to the launch of the Plan:

- **Research.** This phase included acquisition of funding, recruiting of outside partners, establishing leadership and management teams, engaging city departments, and conducting impact, risk and vulnerability assessments.
- **Planning.** This phase included developing, drafting, and vetting the Plan across the Task Force members, and engaging the public.
- **Implementation.** This phase focused mainly on preparing for the release of the Plan, publication of various research reports, and planning for implementation after launch.

Vulnerability and risk assessments as well as adaptation planning to cope with impacts were woven into the process with coequal status in getting reductions in greenhouse gas emissions.

Leadership of the Task Force was under the Mayor’s Office and Department of Environment, but various City departments were given responsibility for developing key strategies and associated actions appropriate to their jurisdictions.

Climate Impacts Report—Assessing Climate Impacts, Vulnerabilities, and Risks. The report on projections and potential impacts was released in September 2008 along with the umbrella Chicago Climate Action Plan. The impacts research served as a means for the city to understand the problem, as well as to identify the benefits of acting in the near-term. Methodologically, the report drew on three climate simulation models, and a host of scientific and statistical downscaling techniques coupled with historic climate observations. The impacts assessment examined two alternative futures including a “higher” global emission scenario and a “lower” emissions scenario. Consequent changes in temperature and precipitation were estimated and impacts were assessed on the public health system, water supply, ecosystems, infrastructure, and other key sectors.

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Economic Risk Report. The City of Chicago “Analysis of Economic Impacts from Climate Change” built off the preliminary findings of the Climate Impacts Report assessing the economic risks to city infrastructure and services under the lower and higher emissions scenarios, by highlighting the benefits of action and costs of inaction. Sectors analyzed included buildings and infrastructure, transportation services, stormwater management, recreation, tourism, local food supply, and insurance.

These two reports played significant roles in drawing attention to the issue and compelling action to launch the Chicago Climate Action Plan and implementation process by defining the problem. They identified potential response paths, and provided a common basis for decision makers and managers to interact with each other and the public on why and how to move forward to adapt to emerging and future climate risks.

Risk Prioritization. A national engineering firm headquartered in Chicago took the information on physical and economic impacts, applied a scoring system based on impact likelihood and consequence, and produced a list of adaptation responses “strategies & tactics” (actions) to the greatest risks. Individual adaptation strategies and tactics were then scored on a scale of 1-5 ranking potential solutions as:

- “Must Do/Early”: Tactics with high net benefit designed to prevent impacts with a short-term time horizon and with few impediments to implementation.
- “Must Do”: Actions with high net benefit, but potential impediments.
- “Investigate Further”: Those tactics that addressed longer-term impacts, but had strong benefit to cost ratios.
- “Watch”: Tactics that could have value in the long term, but were high cost.
- “No Regret”: Options that could deliver benefits greater than their costs, regardless of the extent of future climate change.

Examples of “Must Do” actions included tree planting with the goal of reducing the Urban Heat Island (UHI) effect; and revising air quality ordinances to better handle heat waves. An “Investigate Further” tactic had researchers create a thermal image map of the city to determine neighborhood or building “hotspots,” potentially indicating the locations of vulnerable populations during heat emergencies or where tree planting or green roofs could have greater benefit.

Key Promising Practices from Chicago
- Build on existing commitment.
- Create an organizational process.
- Establish a hierarchy of responsibility.
- Pursue win-win strategies that combine mitigation and adaptation benefits.

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2 A summary of findings can be found in: Corporate Risk Case Study: City of Chicago Climate Change Task Force. Oliver Wyman, Inc.  

3 Further information can be found in: Chicago Area Climate Change Quick Guide: Adapting to the Physical Impacts of Climate Change (For Municipalities and Other Organizations), Edited by Julia Parzen,  

The Miami-Dade County Greenprint

Adaptation Planning. Miami-Dade County, Florida has been working to address the broader implications of climate change for over 20 years. In July of 2006, The Miami-Dade Board of County Commissioners established the Miami-Dade Climate Change Advisory Task Force (CCATF). The CCATF made the county one of the first communities in the U.S. to begin adaptation planning. The CCATF was intended as a multi-year process that would evolve based on current science about anticipated climate change impacts, the viability of available adaptation measures, and the availability of funding over time for implementation.

The CCATF worked through an open process with over 150 stakeholders participating in six sub-working groups. These sub-committees included:

- **Science Committee**—compiled pertinent scientific information and analysis, and advised on potential impacts given certain sea level rise scenarios.
- **Built Environment Adaptation Committee**—provided recommendations for adaptive management of the built environment to predicted climate impacts.
- **Natural Systems Adaptation Committee**—provided recommendations for adaptive management of natural systems to predicted climate impacts.
- **Economic, Social and Health Adaptation Committee**—developed recommendations for adaptive management of economic, social and health impacts of climate change.
- **Intergovernmental Committee**—linked the Task Force and committees to various regional, state, local, and national organizations to help bring in resources and identify opportunities for funding.
- **Greenhouse Gas Reduction Committee**—recommended ways to reduce greenhouse gas emissions in the short- and long-term.

After a “First Report” in 2007, the CCATF delivered its “Second Report and Initial Recommendations” to the Miami-Dade Board of County Commissioners on Earth Day, April 22, 2008. In accordance with the Science Committee’s recommendations, one of the first projects undertaken was LIDAR mapping to create more detailed and accurate coastal maps for sea level rise scenarios. The intention was to identify priority areas and vulnerable infrastructure. Over the last four years, the Task Force has continued to meet to implement recommendations from the Second Report.

The updated 2010 report emphasized the importance of green jobs, land conservation, greater public outreach and education, further engagement with local governments in the region, and active involvement in the Southeast Florida Regional Climate Change Compact. A matrix of recommendations and system for tracking milestones was also instituted. However, many of the original adaptation recommendations from 2008 have yet to be implemented.

**Institutionalized Sustainability.** The Miami-Dade Commission established the Office of Sustainability (OSS) in 2007 to enhance environmental quality and livability in the County and initiated a community GreenPrint program modeled on New York City’s PlaNYC.

**Partnerships Across Governance Scales.** Miami-Dade County is a member of a groundbreaking regional agreement to tackle climate change, including climate adaptation. The Southeast Florida
Climate Change Compact was signed by Miami-Dade, Broward, Palm Beach, and Monroe counties in October 2009 (for more information, see related case study on page 32).

**Key Insights from Miami-Dade County**
- Use successful mitigation efforts to set the stage for adaptation.
- Create a stakeholder engagement process that represents all those who are at risk.
- Make good use of available tools and models.
- Account for the regional nature of adaptation planning.

**PlaNYC’s Adaptation Components**

**NYC Task Force on Climate Change.** Launched by Mayor Bloomberg in August 2008 with the goal of developing a roadmap for adaptation, the task force took a science-based approach to assess the risks from climate change to critical infrastructure. Scientists would provide climate projections, which each organization on the task force would use to assess the magnitude of risk on particular infrastructure (e.g., roadways, bridges, tunnels, airports). The risk assessment would allow stakeholders to prioritize risks and plan adaptation measures accordingly. Addressing the city’s resilience to climate change accounted for one of 127 initiatives in the city’s PlaNYC, a climate and sustainability plan.

**Localizing Climate Projections.** A group of scientists from local academic institutions, along with engineering, legal and insurance experts formed the New York City Panel on Climate Change (NPCC) to advise and provide localized scientific data to the task force. NPCC used 16 state-of-the-art global climate models to generate a single set of future projections under three emissions scenarios (low, medium, high), based on varying assumptions about population and economic growth, the introduction and sharing of new technologies, and land-use changes, which could manifest over the rest of the century.

**Conducting the Risk Assessment.** In February 2009, NPCC’s Climate Risk Information report offered the task force simple climate projections for the mean annual changes in air temperature, precipitation, and sea level rise. The period 1971-2000 served as the baseline for the projections across three timeframes: the 2020s, 2050s, and 2080s. The NPCC also reported on quantitative changes in extreme events: heat waves and cold events; intense precipitation and drought; and coastal floods and storms. Each organization represented in the task force used the climate projections to conduct a risk assessment in two phases. They first identified particular critical infrastructure that was at-risk and the likelihood this infrastructure would be affected by a projected climate impact. Task force members characterized the likelihood of occurrence as low, moderate, or high. In the second phase, the task force members evaluated the magnitude of consequence of each climate impact affecting the infrastructure, using criteria having to do with the effects on the agency’s budget, the regional economy, safety, and the environment.

**Identifying Adaptation Strategies.** Once the task force members completed the risk assessment process, they developed adaptation strategies resulting in a blueprint for building the resilience for the city as a whole.
**Key Insights from PlaNYC**

- Take a science-based approach.
- Engage a wide array of stakeholders.
- Provide risk assessment tools that are easy to use.

**For More Information**

ISC’s 2010 Case Study on the Chicago Climate Action Plan:

ISC’s 2010 Case Study on Miami-Dade County:

ISC’s 2010 Case Study on PlaNYC:
Adaptation Action through Innovative Hazard Mitigation Planning

Communities across the U.S. face serious financial challenges. Austerity measures at every level of government have forced local governments to assume increased responsibility for providing basic services with decreased support from state and federal sources. In this financial environment, communities experiencing the effects of climate change, including devastating storms, flooding, drought and heat events, and recognizing the need to begin adaptation planning, aren’t able to find resources to fund the planning process.

In response to these financial constraints, two communities have recently demonstrated a creative method of funding their adaptation planning processes. In August 2011, the city of Lewes, Delaware was the first U.S. community to approve a plan merging climate adaptation planning with hazard mitigation planning, followed closely by Santa Cruz, California’s adoption of the city’s first climate adaptation plan. Both communities took advantage of FEMA grants for the development of a Local Hazard Mitigation Plan (LHMP) to fund their adaptation planning work. Communities are required to update their LHMP every five years in order to be eligible to receive funding for implementation of pre- and post-disaster hazard mitigation projects, as well as to participate in the national flood insurance program.

Lewes, the first Delaware city to participate in FEMA’s Project Impact initiative, a hazard mitigation program that ran from 1997-2001, began working with ICLEI and Delaware Sea Grant in 2010 to integrate two distinct planning processes: hazard mitigation, which looks back on historic hazard information and impacts, and climate adaptation, which looks at future impacts of climate change and focuses on community resilience in the face of those future impacts. According to Wendy Carey, of Delaware Sea Grant, “The result is the city has a win-win, no-regrets strategy that will prepare them for their future flood risk no matter what the cause.”

Santa Cruz, California, began the process of incorporating adaptation planning into its hazard mitigation planning with the community’s 2007 LHMP, which identified preparing for climate change impacts as one aspect of hazard mitigation. The stand-alone Climate Adaptation Plan adopted in December 2011 coordinates with existing city plans, including its Hazard Mitigation Plan, Climate Action Plan, General Plan, and Emergency Operations Plan. In addition to receiving funding for the adaptation planning process, the Santa Cruz plan states that “having a well-

TWO DEFINITIONS OF “MITIGATION”

- Mitigation (of disaster risk and disaster): The lessening of the potential adverse impacts of physical hazards (including those that are human-induced) through actions that reduce hazard, exposure, and vulnerability.
- Mitigation (of climate change): A human intervention to reduce the sources or enhance the sinks of greenhouse gases.

From Glossary of Terms used in the Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX)

researched and thought-out climate adaptation plan in place creates the opportunity for the city to apply for FEMA and other funding to address identified adaptation priorities.”

In November 2011, FEMA issued a policy statement “establish[ing] an Agency-wide directive to integrate climate change adaptation planning and actions into Agency programs, policies and operations,” paving the way for other communities to follow in the footsteps of Santa Cruz and Lewes in using FEMA funds for combined adaptation and hazard mitigation planning.

Food for Thought
As the two planning frameworks have significantly different terminologies, it’s important to be deliberative about which terms you are using, and state clearly what those terms mean in a combined plan. In communities where there may be political difficulties inherent in discussions of climate change, you may consider whether you want to work within a climate adaptation framework, or whether it might be more effective for your community to address climate change concerns within the existing disaster planning framework.

When considering integrating adaptation and hazard mitigation plans, it’s important to foster a relationship with your community’s emergency manager or mitigation planning team, as well as to be mindful of the five-year time period for hazard mitigation planning. You should be aware of when the next revision of your community’s LHMP is due, as well as when you last received a FEMA planning grant.

Written by Rebecca Webber, Program Assistant for the Institute for Sustainable Communities

For More Information

Lewes, DE:
http://www.csc.noaa.gov/magazine/2011/05/article2.html
Lewes Climate Adaptation Action Plan:
Santa Cruz, CA:
Santa Cruz Climate Adaptation Plan:
Local Hazard Mitigation Planning:
http://hazardmitigation.calema.ca.gov/plan/local_hazard_mitigation_plan_lhmp
FEMA Pre-Disaster Mitigation Grant Program: http://www.fema.gov/pre-disaster-mitigation-grant-program
FEMA Guidance Around Climate Change Adaptation Planning:

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

The Resource
In 2007, as the first cohort of local government climate adaptation plans were being produced, the Climate Impacts Group at the University of Washington, in partnership with King County and the ICLEI-USA, developed “Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments,” a step-by-step guide to the stages of adaptation planning. The guidebook was based in large measure on the experiences of the CIG team working in conjunction with King County staff in responding to King County Administrator Ron Sims’ 2006 executive orders on climate preparedness. Funding for the guidebook was provided by the NOAA Climate Program Office.

Now six years old, “Preparing for Climate Change” remains a bestseller of sorts for practitioners newly assigned to leading a climate adaptation planning process.

The Guidebook is organized around ICLEI’s Five Milestones process for climate adaptation:

**Milestone 1: Initiate a Climate Resiliency Effort.** While this is the first step in the process, it is perhaps the most difficult. Milestone 1 requires that a city identify future climate impacts and make adaptation to such impacts a government priority. To make progress, policymakers must build broad support and a coalition of stakeholders around an adaptation planning process. A team must be put in place to develop and implement an adaptation plan. Without this foundation, the next steps in the process would be extremely difficult, if not impossible.

**Milestone 2: Conduct a Climate Resiliency Study.** To complete the second milestone requires analyzing specific, local climate change impacts. The Guidebook lays out the process for conducting a vulnerability study—identifying which systems are most sensitive and least adaptable to various impacts of climate change—and for conducting a risk assessment, which incorporates the likelihood of impact to vulnerable systems. The vulnerability study and risk assessment provide policymakers with information that will help them prioritize planning areas.

**Milestone 3: Set Preparedness Goals and Develop a Preparedness Plan.** Step three guides the development of a concrete climate adaptation plan that is based on identified priority planning areas. The process begins by establishing a vision of a climate resilient community, which includes dimensions such as public awareness, effective community collaboration, and the adaptive capacity of built, natural, and human systems. The planning team should then set goals within each priority planning area, and identify individual actions to achieve those goals. The vision, goals, and actions are crafted into a comprehensive adaptation plan.
Milestone 4: Implement the Preparedness Plan. To implement an adaptation plan requires a number of specific tools and mechanisms; step four identifies a few of these, including zoning regulations and building codes, community partnerships, and infrastructure development.

Implementing a preparedness plan also requires managing risk and uncertainty. Projected climate impacts, costs, and hazards are impossible to measure quantitatively. One way to manage the uncertainty is to implement “no-regrets,” “low-regrets,” and/or “win-win” actions, which provide some community benefit, whether or not current predictions of climate change impacts come to fruition. Water conservation programs and wetland restoration are two examples of such actions.

Milestone 5: Measure progress and update the plan. The final step in the process calls for monitoring and evaluating adaptation measures and communicating the findings to the community at large. Tracking performance allows policymakers to review their prior assumptions and update the plan accordingly. The evaluation process also provides transparency and accountability to the planning effort.

Written by Tom Wilson, Institute for Sustainable Communities.

For More Information

CASE STUDY: ALBEMARLE COUNTY, VA

Creating an Effective Communications and Public Engagement Strategy
Lessons Learned in Central Virginia

The following case study illustrates how staff leading a regional sustainability planning effort in central Virginia were able to address the concerns of opponents. Although the case does not focus specifically on climate change adaptation, key insights from this public engagement process are applicable to practitioners facing opposition to any community-based planning process.

Background Information

The Thomas Jefferson Planning District Commission (TJPDC) serves six local governments in central Virginia, including the City of Charlottesville and the surrounding Albemarle County. In 2010, TJPDC was awarded $999,000 through the U.S. Department of Housing and Urban Development Sustainable Communities Regional Planning Grant Program to support their Livable Communities Planning Project. In developing this project, the TJPDC has encountered skepticism and opposition from segments of their population that are concerned about the project’s objectives, the role of the federal government in their community and the potential for planning to result in increased regulation and restriction. This experience has prompted TJPDC to develop a robust communications strategy that creates transparency, builds trust, and deeply engages partners and stakeholders in the planning process.

Planning for sustainable development in Albemarle County, VA dates back to the early 1990s, when TJPDC completed “A Study to Preserve and Assess the Regional Environment.” From that study emerged the Thomas Jefferson Sustainability Council and, following a 4-year public engagement process, the 1998 Sustainability Accords which serve as the regional sustainable development plan. In 2010, the TJPDC pursued a HUD Sustainable Communities Regional Planning Grant in order to update the 1998 Sustainability Accords and better integrate regional strategies for land use,
transportation, housing, air and water quality, economic viability and energy use in the region. Specifically, the Livable Communities Planning Project will create six deliverables:

- a common land use and transportation map;
- a performance measurement system;
- a database of local plans;
- recommendations for changes to local comprehensive plans and the region’s long range transportation plan;
- recommendations for changes to codes/ordinances to help implement goals within plans; and,
- recommendations for behavioral changes to further sustainability goals throughout the community.

The proposed Consortium, led by TJPDC, included three major partners: the University of Virginia (UVA), the City of Charlottesville, and the County of Albemarle. In the spring of 2011, the TJPDC set out to confirm the participation of their partners and kick-off their project. At this time, the County of Albemarle was coming under pressure from constituents to drop their membership with ICLEI-Local Governments for Sustainability and with Cool Counties. At the same time, their participation in the Livable Communities Planning Project also came into question. The TJPDC recognized that being responsive to the political climate and creating an inclusive planning process would require a very intentional outreach strategy drawing on the strengths of their partners and the region’s history of long-range planning and public engagement.

Process

Creating a Transparent Process. From the outset of the planning process, TJPDC was committed to carrying out an open and inclusive planning process. “We were 100% committed to community involvement. Despite this really vocal opposition, we still needed this to be a community-driven process. And we also knew that in order to move this forward we needed to get input and feedback from community members. We also really wanted to have open discussions as much as possible. We knew it was going to be hard, but we knew we needed to do it,” explains Summer Frederick, Project Manager at TJPDC.

In order to build trust in the process, TJPDC realized they needed to create a very transparent planning process. “We became transparent as quickly as possible,” explains Frederick. TJPDC launched “Many Plans, One Community” at www.1-community.org to serve as a clearinghouse for project documents and a way to collect feedback. The website contains documents about the project, including the grant application, a draft of the consortium agreement and the final work plan. The website became a crucial platform for sharing information. It features a schedule of upcoming events and meetings, contact information, a blog and a link for community members to electronically submit comments. To drive people to the website, TJPDC rebranded its materials and staff took every opportunity they could to tell people about the project’s online presence. The logo for Many Plans, One Community contains the website address and appears on business cards and informational documents.
The online presence has also extended beyond www.1-community.org. TJPDC set up a page on the social networking platform Facebook, where it hosts polls and posts reminders about upcoming meetings. Project coordinators also use the micro-blogging platform Twitter to disseminate dates of meetings and workshops.

**Engaging Stakeholder Groups.** In order to get targeted input and solicit feedback from existing stakeholder groups, the TJPDC created a group called the “Livability Partnership.” The Partnership currently has approximately 60 members, and is open for any community organization to join. Their members include representatives from environmental groups, neighborhood associations, housing and food advocates, social justice advocates, political committees, and other community groups. Quarterly meetings of the Livability Partnership provide a time for the TJPDC to present updates on the planning process and create an opportunity for small group discussions. Following each meeting, members are assigned “homework” and are expected go back and solicit input from their respective constituents. Each meeting provides Livability Partnership members a chance to report out on their homework and the input they received. This structure allows TJPDC to receive valuable input from a diverse group of stakeholders working on a variety of issue areas.

**Public Workshops.** Given the contentious atmosphere surrounding the project, TJPDC staff sought an alternative to the conventional PowerPoint-plus-Q&A public meeting format. The planning team instead designed a public engagement process structured around smaller, workshop-style meetings that are held more frequently. To share data and information, planners created large poster displays and invited the public to learn about the planning process and provide feedback. Participants at these meetings were given a “post-it” pad and were invited to write their comments and stick them to the posters. Staff members with expertise in a particular topic were on hand to answer questions and engage in one-on-one conversations. Staff also put out large flip charts with open-ended questions where participants could write comments. To ensure transparency, comments were transcribed and posted online within two days for the public to see. The website also allowed people to post additional comments and see posters and handouts that were used at the event. Frederick notes that it’s important for participants to know that planners are listening to their comments and understand how their input will be used to inform the plan. He says, “We are very conscious of taking comments and explaining how those comments, suggestions and feedback will be implemented in the process.”

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**Lessons Learned**

Over the past year, the TJPDC has succeeded in creating a meaningful public engagement process—soliciting input from 500 community members—and in making progress toward the goals of the grant. Along the way, they have learned a number of important lessons.

**Know Your Assets.** The TJPDC found themselves in the position of having to defend planning and the work they were trying to accomplish through the Livable Communities Planning Project. Before developing a public outreach and engagement strategy in this environment, Frederick suggests the first step is for planners to “know your assets.” In the case of their region, TJPDC had the benefit of:
• an engaged public with a history of participation and involvement;
• a history of support for long-term planning;
• dedicated staff and partners;
• a strong governance structure for implementing the grant program, including a good working group and advisory council; and,
• the support of a diverse set of partners, including anchor institutions such as UVA, as well as grassroots organizations.

_Be Prepared._ The TJPDC was very conscientious about preparing themselves and their partners for public meetings and outreach programs. Prior to each event, staff would prepare themselves and their board members and ensure that everyone fully understood the meeting process. In the days leading up to county board meetings, staff took extra time to provide information and answer questions for elected officials. “Board members knew what our project was about and had extensive information in front of them. We made sure they had time to process the information, and that they had their questions answered, so when they were faced with questions from the public they felt comfortable in their answers and in the positions they were taking,” explains Frederick.

For public workshops, TJPDC staffed these events to ensure that there was plenty of staff available to fully engage with participants and answer questions. A two hour orientation was held before each event to ensure that staff members were up-to-date on the project specifics and comfortable with the information on display. Staff assisting with the event were reminded of where to direct questions they couldn’t answer and how to get additional support when they needed it.

_Own Your Project._ In working on their outreach strategy, TJPDC came to understand how important it is to “own your project.” Frederick offers the following advice:

• Understand your community: To be effective, a planner must know their community, including those who support planning and those who don’t. Knowing your constituents will help you to design an effective engagement process and anticipate the challenges and the opportunities you may encounter.
• Be transparent: The TJPDC quickly learned that they needed to be transparent in order to build trust. By building a website, they were able to quickly share all the relevant documents, as well as public comments in an efficient and cost-effective way. Planners should be ready to share any and all documents, and feel 100% comfortable with the content of those documents.
• Be committed: Once the TJPDC and its partners set a process, they committed to carrying it out. While there were efforts to derail the TJPDC process, they maintained strong communications with their partners and were able to define a path forward and stick to it.
• Be flexible: While staying committed to your process, it is also important to stay flexible and to be able to adapt to the needs of the community.
• Be engaged yourself: Says Frederick, “You can’t expect community members to show up and be involved in your process if you don’t show up and want to be involved in your process.”

Lastly, Frederick notes the importance of staying positive and knowing that you are doing good work that will provide long-term benefits to your community.
Thanks to Summer Frederick, Project Manager, Thomas Jefferson Planning District Commission.

Written by Greg Duggan and Debra Perry, Institute for Sustainable Communities.

For More Information

Thomas Jefferson Planning District Commission: http://www.tjpdc.org
Many Plans, One Community: http://www.1-community.org

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Climate Access: Sharing What Works

The Resource
A project of The Resource Innovation Group, the Social Capital Project “aims to increase public support and engagement in environmental and climate policies and programs.” Their work seeks to document best practices and network sustainability practitioners through targeted research, public engagement projects, and trainings for nonprofit, government and business leaders.

Since their founding, Social Capital Project staff heard climate practitioners repeatedly speak to the challenge of effectively communicating across difference—in particular to the public. Climate Access seeks to connect on-the-ground initiatives with emerging resources from research on climate, energy, and sustainability policy.

The Climate Access website is designed to facilitate peer exchange. The site includes publicly accessible materials as well as password-protected elements, such as practitioner forums, an archive of roundtable discussions, and a network directory. In all, the site features:

- **Resource Hub**, an extensive and ever-evolving library of research, news articles and commentary on climate change communications, behavior change and public opinion.
- **Collections** of expert recommendations on the most helpful resources on various topics.
- **Campaign Gallery**, a compilation of compelling communications and behavior change campaigns.
- **Blog** posts on the latest and greatest developments in public opinion and engagement.
- **Roundtables**, interactive conversations with leading climate and behavior change experts.
- **Tips and Tools** that can be applied to programs and campaigns, including expert recommendations, exclusive interviews and case studies.
- **Member Forums** that are moderated and password-protected and organized by sector.
- **Network Directory** to help users find and connect with colleagues.

To join, potential members credentials are reviewed by Climate Access staff, ensuring that all networking participants are climate practitioners—in other words, “those working—or volunteering—at nonprofits and government agencies where at least part of one’s role is to communicate with and engage the public in addressing climate issues.” Organizations and coalitions are also encouraged to create sub-networks within the site that serve as private forums for allied practitioners to discuss challenges, opportunities, ideas, and even to share confidential materials and strategize.

Written by Nathaly Agosto Filión, Program Officer, Institute for Sustainable Communities.

For More Information

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Building Local Food Systems to Increase Resiliency

This Emerging Issue Brief is meant to help local government officials and their key stakeholders expand their understanding of how food systems can increase climate adaptation and resilience.

Background

Food systems consist of how we grow, process, distribute, access, consume and dispose of food. More and more people are taking a concerted interest in the food they eat, where it comes from, how it was grown or processed, and even the scale of their food system, particularly how far their food has traveled. Witness the extraordinary growth of the organic food industry which managed to grow 17% in recession-ravaged 2008, with sales reaching $26.8 billion according to the Organic Trade Association.1 Or the development and adoption by the American Dietetic Association, the American Nurses Association, the American Planning Association, and the American Public Health Association in June 2010 of shared food system principles to support socially, economically and ecologically sustainable food systems for the health of individuals, communities, and the natural environment.

Much of this growing interest can be attributed to concern about the conventional global industrial food system and how it impacts personal, environmental, economic, and societal health. According to the Food and Agriculture Organization of the United Nations, approximately 30% of global energy consumption is used in food production, which results in 20% of global greenhouse gas emissions.2 The World Bank estimates that 33% of the world’s freshwater reserves are consumed by food production. Additionally, globalization coupled with sprawling development patterns has contributed to the loss of farmland in nearly every community in the US—about an acre per minute from 2002 to 2007, according to the American Farmland Trust.3 And many low-income neighborhoods suffer from a lack of access to fresh, healthful food—the so-called “food deserts.” This limited access often results in poor eating habits that have significant impacts on health. According to the Centers for Disease Control and Prevention, one-third of adults and nearly 17 percent of youth are obese (2009-2010 data).4 Lastly, the EPA estimates that wasted food is the single largest component of the US waste

3 http://www.farmland.org/
stream by weight.\textsuperscript{5} This food waste causes significant methane gas (a greenhouse gas, 20 times more damaging than carbon dioxide) emissions as it decomposes in landfills.

**Local Food Systems**

Recently local food systems have received significant attention for those looking for food that is more socially responsible, environmentally sustainable, and economically beneficial. Several books have been published extolling the virtues of eating within a “100-mile diet” and there is growing concern over “food miles”—the distance food travels. Close study of this one issue of fuel use, however, has shown that local food transportation may not necessarily be more fuel-efficient than the transportation of global food.\textsuperscript{6} Often, this is simply due to the transportation mode and efficiencies of scale. For example, large ships and freight trains can carry significant quantities of food great distances very efficiently. These larger food loads often have a lower fuel-used-per-unit-of-food ratio than many current local food distribution systems (e.g. small to mid-sized trucks).

Also, several studies have recently attempted to quantify just how capable a given region is at growing enough food to feed its population. In a 2009 study by the Delaware Valley Regional Planning Commission (DVRPC) researchers found that the Greater Philadelphia region falls short by 40% of the acres they need to feed themselves.\textsuperscript{7} A similar study of New York State found that their production capacity could support only about 20% of their food needs.\textsuperscript{8} These results have led many food systems pioneers to try to expound upon local food systems in favor of much broader regional food systems made up of multiple states.\textsuperscript{9}

Food systems experts Kate Clancy and Kathryn Ruhf, in a 2010 *Choices Magazine* article\textsuperscript{10} make the case for regional food systems that include “multiple ‘locals’ within a state, and those that cross state boundaries... [and] operate in relation to other regions as well as to the national and global food systems.” In other words, regional food systems are “nested,” to take full advantage of local food supplies. “An ideal regional food system describes a system in which as much food as possible to meet the population’s food needs is produced, processed, distributed, and purchased at multiple levels and scales within the region, resulting in maximum resilience, minimum importation, and significant economic and social return to all stakeholders in the region.” They refer to this model as “self-reliance,” as opposed to “self-sufficiency,” in which “everything is eaten and supplied within the target area.”

\textsuperscript{6} http://www.telegraph.co.uk/earth/agriculture/food/4277371/Long-haul-food-produces-lower-carbon-emissions.html
\textsuperscript{8} Peters, CJ, Fick GW, Wilkins JL. Testing a complete-diet model for estimating the land resource requirements of food consumption and agricultural carrying capacity: The New York State example. Renewable Agriculture and Food Systems. 2007; 22(2): 145-153
\textsuperscript{9} See the Food Solutions New England program: http://www.foodsolutionsne.org/
\textsuperscript{10} http://www.choicesmagazine.org/magazine/article.php?article=114
Climate Impacts
Food systems are further complicated by the impacts of climate change. The Russian wheat crisis caused by drought and massive wildfires in the summer of 2010 sent prices soaring. This significantly increased prices for US growers that export much of the wheat they produce (Colorado, exports 80% of its wheat). However, the tables could easily be turned and some suggest that the heat wave that hit major sections of the US this summer 2012 is an indication of the shifting patterns of climate variability.

The variability of climate change or climate disruption presents a unique challenge to food systems at every scale. Steve Cohen, Food Policy and Program Manager at the city of Portland Bureau of Planning and Sustainability framed the issue this way: “When you think about food from a climate adaptation and resiliency perspective, it’s difficult to know where to begin as our global food system is so complex. Increasing production and consumption of local food has many positive benefits, but it’s not the singular solution from a resiliency standpoint. Communities and cities are best served by considering how local, sustainable agriculture can help build resilience—and improve community health and economic opportunity—by diversifying the sources and the kinds of food we depend on.”

While local food systems may not always be more transportation efficient and while it may not be possible for everyone to eat within a “100-mile diet,” there is still significant value in working to improve and support the development of more sustainable, local, and regional food systems, including:

- **Environmental Impacts:** Organic food and sustainable agricultural practices improve water quality, reduce erosion and soil loss, reduce toxic pesticide/herbicide use and the use of synthetic fertilizers, and help protect wildlife, pollinators, and many other species.
- **Social Health Impacts:** Having access to—and consuming—fresher, unprocessed food has a significant impact on improving health. Especially that of the U.S. population that suffers from heart disease, diabetes, and obesity.
- **Economic Impacts:** The burgeoning local food and organic food market is providing new job opportunities for many new farmers and food entrepreneurs. Direct-market sales support farmers and business owners, which can be part of a strategy to protect a region’s “working landscape” by making it economically viable again. Also the money spent not only stays within the local economy, but is multiplied often by 2-4 times the initial investment (the “economic multiplier effect”) as the farmer or business owner spends a significant portion of their earned money on goods and services from within their region.

Examples of Food Systems Advancement in the U.S.
Increasingly, cities and regions across the U.S. are seeing—and seizing—significant opportunities to improve their communities’ economic, environmental and social health by working to transform the broader system(s) by which food in their communities is produced, distributed and consumed, and food waste is managed. The resulting initiatives are improving public health, reducing food related inequities, circulating money in local economies, creating new business opportunities and jobs, and reducing the environmental impacts of agriculture. Importantly, these programs are bolstering food security and community resilience to potential shocks to food systems which include an
unpredictable climate, increased pest resistance, and declining or increasingly expensive supplies of water and energy.

To advance these initiatives community leaders and sustainable food system advocates face a number of hurdles, including the absence of proven methods for improving food systems; the challenge of collaborating with a wide range of stakeholders—to eliminate food deserts for example, and increase opportunities for more local food to make its way to consumers; to gain political support for much needed food system policy changes; to create appropriate governance structures and appropriate venues for community feedback; and to find funding for this work. Despite these challenges there is significant activity, experimentation, and innovation emerging at the community and municipal level.

Promising Practices

Communities from New York City, New York to Portland, Oregon are developing comprehensive food system plans and programs to increase the production and consumption of local, sustainable food. *Homegrown Minneapolis* is one leading example. In addition to making vacant city lots available for community gardens, community leaders have created a business development and financing resource guide to assist small local food entrepreneurs; and they have worked to facilitate low-income residents’ use of subsidized SNAP debit cards (Supplemental Nutrition Assistance Program, formerly known as food stamps) at farmer’s markets, to increase their access to fresh local food.

Other cities have developed programs to identify and address “food deserts”—places where there is inadequate and inequitable access to healthy food. New York City’s *FRESH Program* (Food Retail Expansion to Support Health) increases access to healthful food in underserved communities by encouraging new supermarkets to be built in those places through zoning and tax incentives. To date, 10 markets have been built and four additional stores are being planned. The Green Cart program, also in New York City, provides nutritious food into underserved communities through the authorization of permits for street vendors who only sell fresh fruits and vegetables. The program is a win-win, allowing the city and entrepreneurial small business owners to address a social problem through a sustainable enterprise.

According to the Community Food Security Coalition, more than 100 states, counties, and cities—including Boston, Seattle, Oakland and many others—have established specific food policy councils to guide their efforts. These councils identify and pursue necessary policy changes which foster the high level of collaboration across agencies, jurisdictions and sectors necessary to create and

15 http://foodsecurity.org/category/home/
maintain more sustainable food systems. For example, the Boston Food Council,\(^\text{16}\) established by Mayor Thomas Menino in 2008, includes representatives from the Boston Public Health Commission, the Boston Redevelopment Authority, the Boston Public Market Association, and a number of other food/health-focused private and nonprofit sector organizations.

Finally, cities such as San Francisco, Seattle, Portland, and Boulder have implemented aggressive curbside composting programs, to divert food waste away from their municipal waste streams.

**Western North Carolina’s Food & Natural Products Cluster**
Some communities are creating whole new economic development clusters around sustainable, local food production, consumption, and agriculture. In Western Northern Carolina, for example, AdvantageWest (Western North Carolina’s regional economic development agency) is leading an impressive sustainable economic development effort, which, among other activities, is working to transform the focus of the region’s rich agricultural economy, historically dominated by tobacco.

In 2006 the Western North Carolina Natural Products Association produced a study that explored the region’s assets documenting the status of its natural products sector and identifying key partners and strategies that would be critical to expanding this industry. To turn this study into action, AdvantageWest developed a four-step approach intended to support the natural products supply chain, from the cultivation of “raw materials” to product development and manufacturing, market development, testing and certification.

One of AdvantageWest’s most successful programs has been Blue Ridge Food Ventures (BRFV).\(^\text{17}\) BRFV was first conceived as a facility that would serve local farmers, enabling them to tap into markets for value-added products. Over time, facility developers learned that farmers were not their primary clients, but that many entrepreneurs in the area were interested in using the facility to pursue the development of products that ranged from traditional jams, jellies and hot sauces to tempeh, bamboo pickles and raw chocolate (UliMana’s raw organic chocolates prepared at BRFV have been spotted for sale as far away as Oakland, California). Currently the 11,000-square-foot facility (known as a “food hub”) serves as the nation’s first shared-use business incubator and natural products manufacturing facility. Since it opened in 2005, BRFV has helped more than 170 small businesses get started, generating over $3.5 million in sales and services.

The region’s success in supporting its food and natural products cluster has been due in part to the focus on tapping into both national and international markets as well as those close to home. Through the Winter Sun Farms Community Supported Agriculture (CSA) program, produce harvested during the growing season is prepared, packaged and frozen at the BRFV facility. Once a month from December through March, members receive an assortment of locally grown produce. In

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\(^{16}\) [http://www.eosfoundation.org/newsroom/g_boston_food_council.htm](http://www.eosfoundation.org/newsroom/g_boston_food_council.htm)

\(^{17}\) [http://www.advantagewest.com/content.cfm/content_id/144/section/food](http://www.advantagewest.com/content.cfm/content_id/144/section/food)
2010, the program supported 13 regional farmers and processed close to 15,000 pounds of fresh produce for its 225 subscribers; the CSA has since grown to over 300 members. The region’s locally grown certification program, Appalachian Grown, recorded sales of $68 million in 2011.\(^{18}\)

Working in collaboration with educational, nonprofit, and private sector partners, AdvantageWest is creating programs, infrastructure and a professional network to support the development of this regional food and natural products cluster, which not only furthers economic development goals, but also helps to maintain the agricultural history and preserve the working landscape of Western North Carolina.

### The Opportunity

To feed a growing world population, increasing agricultural output at both the local, regional and global level will be necessary, and all food must be produced in more climate mitigating and climate resilient ways. As Beddington, et. al. concluded in their report “Achieving food security in the face of climate change,” this will require “…efficient use of resources, improved marketing and distribution infrastructure, low-waste supply chains, and more consumer choice for healthy diets.”\(^{19}\)

Working to strengthen and sustain city, state or regional food systems helps increase economic diversity. Supporting and nesting local within regional food systems creates redundancy and increases both economic and environmental resilience to climate change, while also significantly improving public health.

Around the U.S. this change is already happening as cities and communities develop innovative solutions to advance sustainable food systems and support new entrepreneurs. As these initiatives develop, they provide replicable models for other communities and help citizens create new relationships with food, farmers, and the land, all of which are important steps in adapting to a new climate.

*Thanks to Steve Cohen, Food Policy and Program Manager at the City of Portland Department of Planning and Sustainability*

*Written by Josh Kelly, Institute for Sustainable Communities*

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\(^{18}\) Appalachian Grown is a program run by the Ashville-based nonprofit Appalachian Sustainable Agriculture Project. See [www.buyappalachian.org](http://www.buyappalachian.org) for more information.

CASE STUDY: SOUTHEAST FLORIDA

Southeast Florida Regional Climate Change Compact
A Promising Model of Government Collaboration around Climate Adaptation

Background

The four counties of Southeast Florida—Palm Beach, Broward, Miami-Dade, and Monroe—have been working together since 2009 to coordinate climate change mitigation and adaptation action for a region home to 5.5 million people and nearly one-third of Florida’s total statewide economy. The initiative is based on an understanding of shared concerns, and is driven by strong leadership and a commitment to fostering relationships. The initiative has a diverse funding strategy, and is becoming a promising model of how governments can collaborate on climate planning across jurisdictional boundaries.

In May of 2009, elected officials and staff representing several Florida counties, including Broward, Miami-Dade, and Monroe traveled to Washington D.C. to attend the Local Climate Leadership Summit, to seek Congressional support for a national climate policy, and to bring attention to the unique vulnerabilities that climate change poses for Southeast Florida. On this trip, the group realized that they were all trying to tell the same story about climate change in Florida, but that they were using different information. Their projections for sea level rise and maps of vulnerabilities, for example, differed markedly. The discrepancies detracted from their shared message because it meant that the Southeast Florida delegation had to spend time explaining the differences while building a case for their adaptation needs. These discrepancies, once noted by the delegation, spurred a discussion about the need to generate a common message and garner the regional attention and support of other elected officials. Commissioner Kristin Jacobs of Broward County, who had experience with regional water

Counties participating in the Southeast Florida Regional Climate Compact.
initiatives, directed her staff to organize a summit of Southeast Florida officials. The purpose of the summit was to kick off regional collaboration on climate strategies. Though these strategies would encompass both mitigation and adaptation, the summit would maintain a focus on adaptation because it provided an effective rallying point, given the anticipated regional impacts of climate change on sea level rise, drainage and flood control system operations, and local water supplies.

Process

Southeast Florida Regional Climate Change Leadership Summit. Broward County, working with the three other Southeast Florida counties, led the organization of the SE Florida Regional Climate Change Leadership Summit on October 23, 2009. ISC’s Senior Advisor for Climate Adaptation Steve Adams (then working at the Climate Leadership Institute at the University of Oregon) provided policy guidance, while Broward County staff in the Natural Resource Planning & Management Division set the overall framework for the event. Representatives from all 109 municipalities in the four counties were invited, resulting in over 300 people in attendance. Nearly half of those attending were elected officials from local, county, state, and federal agencies. Other attendees included regional government staff in transportation, planning, water management, and climate. The context for the day-long summit was set by national experts and federal officials. The counties shared their existing efforts and regional considerations in transportation, water, and land use, and one Commissioner from each of the four counties participated in a panel discussion of focal points for regional collaboration. The day ended with a press event where Commissioners signed the Southeast Florida Regional Climate Change Compact.

Southeast Florida Regional Climate Change Compact. The Compact committed the Counties to three actions:

1. Coordination in development and advocacy of climate legislation at the state and federal level;
2. Developing a Southeast Florida Regional Climate Action Plan; and
3. Hosting an annual summit to document progress and coordinate future activities.

At the conclusion of the Summit, each of the county representatives
then had to gain support for implementation of the Compact’s commitments from their county boards of commissioners. By January 2010, each of the four county boards had unanimously adopted the compact.

During 2010, the four counties focused on developing the governance process to meet compact objectives. A Compact Staff Steering Committee was formed composed of two representatives from each county and one representative of the District. The counties assigned senior personnel to the committee including county managers, deputy managers, sustainability directors, and environmental department directors. In addition to building the core governance model for the Compact, the four counties developed working groups to complete specific tasks called for by the Compact agreement and to accomplish the Regional Climate Action Plan. Over the course of this process, ISC’s Steve Adams facilitated meetings of the Compact Steering Committee and working groups established to complete specific tasks.

A Policy Coordination Work Group of intergovernmental staff from each county was formed to reach consensus on energy and climate change policy positions for the state legislature and the Congress. For the 2011 and 2012 county policy development process, the Policy Group provided unified state and federal policy positions that were subsequently adopted by each of the four county commissions on substantive legislation and appropriations. Since 2011, the commissions have instructed their state and federal lobbying teams to work together on these issues.

**Developing a Regional Green House Gas Emissions Inventory.** As a precursor to the Regional Climate Action Plan, the Compact Staff Steering Committee organized a regional greenhouse gas emissions inventory team to collect data to support the completion of a regional emissions inventory. The regional inventory leveraged three existing county-level inventories previously completed while assisting the fourth county in developing a data collection process that did not previously exist. The primary technical challenge faced by the counties in developing the regional inventory was establishing a baseline year given the decrease in regional emissions driven by an economic recession that began locally in late 2007. This was accomplished by developing a weighted average of emissions over five years of data from 2005 through 2009, which enabled Compact participants to better understand the relationship between robust economic growth, in 2005 and 2006; and recessionary local economies, in 2007 and 2008; and a local economy enjoying a modest recovery, in 2009.

**Developing Regional Sea Level Rise Projections.** Also during this time, the Compact Staff Steering Committee prioritized the creation of a “unified sea level rise projection” for use in Compact planning and communications, prior to the development of a Regional Climate Action Plan. The Staff Steering Committee convened a technical advisory group of local scientists from academia and federal, state and local agencies to assess the latest literature on sea level rise and provide a final recommendation for use in the planning process. After several meetings, the group recommended a range of between three to seven inches by 2030 (from a 2010 baseline) and nine to 24 inches by 2060. The group demurred on providing a projection for 2100 given the amount of academic activity currently underway to meet the end of 2012 publication deadline for inclusion in the IPCC’s 5th Assessment Report due in 2014. The Staff Steering Committee accepted these recommendations for use in the regional planning process and further requested that the technical advisory group
reconvene in early 2013 to provide adjustments to these recommendations for 2030 and 2060 as well as provide a projection through 2100.

**Assessing Regional Vulnerabilities.** To understand regional vulnerabilities to projected climate impacts, the Compact participants recognized the need for a consistent process of assessing natural and built assets of regional importance across the four counties. To accomplish this task, the Staff Steering Committee organized a Regional Vulnerability Assessment Working Group. Using recently flown light detection and ranging (LIDAR) data provided by the Florida Division of Emergency Management (FDEM) with significant post-processing by the South Florida Water Management District, the counties were able to first develop a protocol for determining sea level rise impact and inundation assessment for 18 classes of natural and built infrastructure across the four counties including such assets as natural areas, roads and bridges, schools, hospitals, hurricane evacuation routes, police and fire stations and water supply facilities. NOAA’s Coastal Services Center and the US Army Corps of Engineers Jacksonville District provided a regionally consistent water surface (based on interpolated tidal gauge data) and inundation coverages for one, two and three feet inundation scenarios. As a result, the counties were able to assess inundation at the parcel level with a consistent means of demonstrated uncertainty created by the vertical datum derived from the FDEM LIDAR data set. With the completion of the Regional Vulnerability Assessment in 2011, the Compact’s working groups were ready to begin the task of developing the Regional Action Plan.

**A Regional Climate Action Plan is Created.** With the assessment and analysis phases complete, the Staff Steering Committee organized three working groups—Built Environment, Transportation and Land & Natural Systems—to develop specific recommendations for reducing emissions and building climate resilience across the four county region. Each of the three working groups were chaired or co-chaired by a member of the Staff Steering Committee. After formation in early 2011, the three action plan working groups provided initial draft recommendations to the full Staff Steering Committee in a two-day retreat held in Key Largo in July 2011. After review and comment, the Staff Steering Committee provided guidance to the three working groups in finalizing the strategies to be included in the Regional Climate Action Plan and convened a “super committee” to address cross-cutting issues that emerged separately from the three working groups. The Draft Regional Climate Action Plan was released for public comment at the conclusion of the 2012 Regional Climate Summit held in Key Largo on December 8th and 9th of 2011. Following a 90-day public comment period in which over 100 comments were received, the Regional Climate Action Plan has been completed and will shortly be submitted to the four county commissions for their consideration in the fall of 2012.

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**Lessons Learned**

**Building Buy-in in the Face of Political Challenges.** Not all of the four counties had Boards that immediately supported regional collaboration. They eventually agreed to support the effort for two reasons:

- **Recognition of changes in the physical environment.** Though philosophies differed on the validity of anthropogenic global warming, the four counties have all experienced salt water entering drainage culverts, and extreme high tide events causing seawater to overtop sea walls and flood people’s backyards with greater frequency. Officials could all appreciate the...
need to make investments to respond to these trends, look beyond the inevitable historical contentions among the counties, and commit to working on sea level rise issues together.

- **Leverage.** By collaborating, the counties could enhance their ability to gain additional resources for the huge task at hand, too great for each of them to tackle alone. Together the 109 municipalities of the four counties represent one-third of the state economy and 5.5 million residents. As a group, the four counties could better command money for adaptation.

The regional scale of the Compact has enabled participants to develop resilience strategies that effectively integrate human and natural systems. The Regional Climate Action Plan has effectively connected resilience efforts within the urban core of Southeast Florida with broader ecosystem scale efforts including comprehensive Everglades restoration, protection of the Southeast Florida coral reef track, and regionally important threatened and endangered species and habitats. The ecosystem services provided to the human settlements of the region are evident in the nature of projected vulnerabilities such as salt water intrusion into local drinking water supplies and the increased exposure to storm surge impacts associated with the loss of natural barriers. The strategies developed to enhance environmental and habitat quality fully recognize the benefits these strategies will have for the ongoing livability of the region.

**Successful Coordination Requires Extensive Communication.** Dr. Jennifer Jurado, Director of Broward County’s Division of Natural Resources and Management, who has led the initiative at the staff level for her county, said that “extensive communications” has made the Compact work. She attributes the achievement of the four-way collaboration to the time taken initially to understand the points of view of the respective Boards of Commissioners and to build relationships across the counties.

**Stepwise Leadership.** Commissioner Kristin Jacobs of Broward County provided early leadership by initiating the conversation about collaborating with the other county representatives and by dedicating staff to the effort. Jacobs also solicited the support of a counterpart in each of the three other counties to sign the Compact. Each of these commissioners then sought and won support for the initiative from their full county boards. From this initial leadership, support has grown even as early champions have rotated off of the respective county boards during the 2010 elections and newly elected officials have embraced the process.
One Framework for Collaboration Facilitates Other Joint Activities. Collaboration on adaptation under the Compact is allowing the counties to work together on other political issues. The counties, for example, organized a shared press event to voice their concerns about the BP oil spill. During the event, Commissioners from each county signed a joint letter to Congress, the Obama Administration, and the Florida State Legislature urging action, including passage of “comprehensive climate change legislation prior to the end of the Congressional session.”

The Compact has become an effective means of changing local and state policy. During the 2011 state legislative session, the Compact Counties successfully lobbied for a provision in Florida’s growth management laws that would enable local government to designate areas as “Adaptation Action Areas” as a means to prioritize investments for building resilience while guiding future development. The annual policy coordination process has been completed twice since initiation and is providing a model for county cooperation on other policy issues of regional importance.

Diverse Funding and Support Strategies. As money specifically for climate adaptation work is not readily available, the Compact Counties have a diversified fundraising strategy, including pursuing federal appropriations, EPA Smart Growth Initiative, and NOAA Climate Program opportunities. The Compact provides a national model for state and federal agency engagement with local government around the specific issues of place. As the Compact is led by local government and further, as the Compact represents a significant aggregation of effort by four counties containing over 100 municipalities, it has become a highly efficient mechanism for state and federal agency engagement in the local process. Since its beginnings in 2009, the Compact has received extensive technical support from NOAA, USGS, the Army Corps of Engineers, EPA Region IV as well as the Florida Department of Transportation, the Florida Department of Economic Opportunity and the South Florida Water Management District.

The creation of the Regional Compact in 2009 was an important precursor to the region’s successful bid for a $4.25M Sustainable Communities planning grant from HUD in 2010, even including a 7th livability principle of “climate resilience” within their initial application. With grant funding, the South Florida and Treasure Coast Regional Planning Councils are leading the development of “Seven50,” the 50-year blueprint for a larger seven region area which the four Compact Counties are lending their experience in leading development of the climate change elements.

Written by Elaine Wang and updated by Steve Adams, Institute for Sustainable Communities
For More Information

Southeast Florida Regional Climate Change Compact.  
http://www.southeastfloridaclimatecompact.org

Southeast Florida Regional Climate Action Plan (draft).  

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From Forests to Faucets
A Partnership Between Denver Water and the U.S. Forest Service

The partnership known as “From Forests to Faucets” between Denver Water and U.S. Forest Service (USFS) is an example of emerging efforts to monetize “ecosystem services”—in this case, protecting the value provided by forested lands within mountainous catchment basins for the provision of sufficient and quality water for the City and County of Denver. Through this innovative partnership, Denver Water is providing matching funds for the USFS to improve forest health, reduce wildfire risks, and prevent costly wildfire impacts to the water collection system. This partnership illustrates the linkages between natural systems and the services they provide to metro areas—and offers insight into creative solutions for managing the forest-fire-water supply nexus that will increase in importance in the context of a changing climate regime for the American West.

On June 8, 2002 the largest forest fire in Colorado’s history began with an act of arson some 95 miles to the southwest of Denver. For the next 20 days, the Hayman Fire burned 138,000 acres causing over $40 million in firefighting costs and destroying 132 homes. Six fatalities were attributed to the fire. The USFS Hayman Case Study requested by Congressman Udall provided the definitive account of the extraordinary conditions that led to the severity of the fire. Drought conditions that began building in 1998 resulted in the lowest fuel moisture conditions within Front Range forests observed in over 30 years. On the day of the ignition, a low pressure system in the Pacific Northwest drove 15 mph winds out of the southwest with gusts exceeding 30 mph. Despite an aggressive early attack by firefighters, the fire front grew dramatically due to the exceedingly dry conditions, the wind, and a dense forest stocked with even-age ponderosa pine and Douglas fir.

After surveying the fire in progress from a helicopter, Colorado Governor Bill Owens said, “it looks like all of Colorado is burning today.”

Forests throughout the West are experiencing an increase in bark beetle infestations (mountain pine beetles have affected 3 million acres of forested land in Colorado alone) and widespread mortality of aspen, both of which have been linked to climate change. As Denver Water notes, “the heart of the [mountain pine beetle] epidemic in Colorado and Wyoming contains the headwaters for rivers that supply water to 13 Western states.” Compounding forest management in a warming climate is the legacy of nearly a century of aggressive federal and state fire suppression policy that interrupted historic fire regimes. The result for many forests is greater density of even-age stands, facilitating more frequent mass fire events. The USFS determined that the site of the Hayman Fire had an average fire interval of 50 years in the nearly six centuries from 1300 to 1880, but no significant fire from 1880 to 2002.

The Hayman Fire and the nearly 12,000 acre Buffalo Creek Fire of 1996 occurred within the watershed that comprises a large portion of the water catchment area for Denver Water, the municipal supplier for more than 1.3 million people in the greater Denver area. Periods of heavy rain flushed more than 1 million cubic yards of sediment into nearby Strontia Springs Reservoir despite $37M in restoration and stabilization projects by the USFS on burned over lands. As a result
of these fires, Denver Water has incurred over $26M in costs on water quality treatment, sediment and debris removal, reclamation techniques, and infrastructure projects to date.

In August of 2010, Denver Water and the USFS signed a contract creating “From Forests to Faucets” in which Denver Water will provide $16.5M in funding to match an equal amount provided by the USFS (totaling $33M). The forest treatment activities are considered a form of “payments for watershed protection” by USFS officials, who have been engaged in similar ecosystem services projects in federally owned forested landscapes in New England. Over the next five years, the Forest Service will administer and oversee a range of restoration activities, including forest thinning and other fuel reduction projects to reduce the risk of catastrophic wildfire on Denver Water’s collection system.

The work will be performed on land owned by the Forest Service in the Upper South Platte River, South Platte River Headwaters, St. Vrain River, Colorado River Headwaters, and Blue River watersheds, which are the primary water supply source areas for Denver Water. According to Denver Water:

“The Denver Water-funded treatments will be focused in specific ‘Zones of Concern’ within these larger watersheds identified through an assessment that analyzed and ranked wildfire hazards, flooding or debris risks, soil erodibility and water uses. This methodology was developed in 2009 in a collaborative effort by Front Range water providers, the United States Forest Service, Colorado State Forest Service, United States Geological Survey, United State Bureau of Land Management, the Colorado Department of Public Health and Environment and the United States Natural Resources Conservation Service. This has become the accepted methodology by all agencies to identify and prioritize ‘at risk’ watersheds for hazard reduction treatments and other watershed protection measures.”

As the largest “payment for watershed protection” effort in the nation, this effort to treat 38,000 acres of forest over five years is designed to forestall much higher future costs for Denver Water. According to Don Kennedy, Environmental Scientist at Denver Water, and the leading staffer coordinating the partnership efforts, these collection agreements were put together to get work done on the ground to reduce risk. “It’s so much cheaper to do something now as opposed to waiting for something catastrophic to occur.” But the outcome of these efforts will also increase
forest resilience to bark beetle infestations, reduce wildfire risks for communities, and improve habitat for fish and wildlife species. Similar projects are being explored elsewhere around the West, including the Four Forest Restoration Initiative in Arizona as well as early efforts in New Mexico, and other parts of Colorado.

Innovative partnerships that yield unconventional funding strategies are critical for addressing community-scale climate resilience concerns in a time of increasingly scarce public sector funds. Kennedy advises practitioners looking to replicate this partnership to seek out partners which overlap on areas of concern in the landscape to build robust collection agreements. This project also demonstrates the benefits of “systems thinking” in addressing resilience challenges. The cost, quality and reliability of Metro Denver’s water supply is in large measure determined by the conditions of forests over 100 miles away from the city. By considering preventative measures, Denver Water and the Forest Service are reducing the risk that Denver Water’s customers will face expensive future outlays should the perfect conditions for mass fire arise as they did on June 8, 2002.

Written by Steve Adams, Institute for Sustainable Communities; updated by Nathaly Agosto Filión, Institute for Sustainable Communities.

For More Information

Denver Water’s From Forest to Faucet website: http://www.denverwater.org/SupplyPlanning/WaterSupply/PartnershipUSFS/

Models for Mainstreaming Adaptation

For the first ISC Resource Guide on Adaptation & Resilience, staff prepared case studies documenting the experience of practitioners from various disciplines in Seattle and New Orleans in implementing strategies that bolster climate resilience within the context of water supply planning, public works, land use planning and redevelopment. The full case studies are available on ISC’s Sustainable Communities Leadership Academy website. This synopsis captures in brief the lessons learned as previously documented.

Seattle Public Utilities – Water Supply Planning
Few people might suspect that Seattle’s water supply is at risk. The city has long been known as a place of abundant water. For more than a century, it has met all its water supply needs with snow melt and rainfall from two mountain watersheds a short drive away. Despite this long history of ample water, Seattle Public Utilities (SPU), the city’s publicly-owned water utility, turned its attention to the potential water supply risks from climate change more than a decade ago.

Hydrological Modeling. Since 2002, SPU has collaborated with the University of Washington’s Climate Impacts Group on regional hydrological modeling—initial modeling suggested that under a moderate risk scenario, Seattle was projected to lose 13% of its water by 2050. SPU used the assessment as a basis for assembling a portfolio of adaptation strategies that could offset expected losses and make the city’s water supply more resilient to climate change.

Looking for Effective Adaptation Options. Since climate impacts were not forecasted to be severe before 2050, SPU looked most closely at “no regrets” operational options that could be implemented by the utility itself in the near term and without significant cost to its rate payers, such as drawing down water levels in a reservoir below typical operating levels.

Seattle Public Utilities – Flood Risk Management
Seattle experienced two of the most damaging storms in its history in 2006 and 2007. The first storm, in December 2006, produced intense rainfall over a single hour. The city’s natural and artificial drainage systems could not accommodate all the runoff that resulted, and water rapidly flooded streets and buildings.

Another record-breaking storm struck in December 2007, this time dumping nearly five inches of rain on Seattle in a 24-hour period. Again, severe flooding occurred throughout the city, with some properties having as much as four feet of stormwater in basements and on ground floors.

Both incidents represented 100-year storm events (i.e. the rainfall released during each storm exceeded the amount the city would expect for a storm of its duration once every hundred years).
Assessing the Increased Risk of Flooding. SPU hired consultants to examine historic rain data collected at 17 rain gauges across the City and analyze whether the frequency of extreme precipitation events had increased. The analysis showed a “weak increasing trend...in the number of days on which 25-year or greater precipitation events are recorded by at least one gauge.” The conclusion was that every 3.2 years, SPU could expect a storm to produce a volume of rainfall exceeding 100-year or greater precipitation events somewhere in the city.

Improving Data Collection. SPU’s assessment of historic rain gauge data left no doubt that the utility should expand and improve the information it had available for analyzing localized precipitation trends. The utility added 11 new rain gauges to its network, locating them in places where robust information about rainfall patterns was not yet available. It also improved procedures for gauge maintenance to increase the reliability of the record.

SPU also launched a new program to create better “eyes and ears” out on city streets when major storms strike. A new group of “storm observers”—utility planners and engineers who had no explicit emergency management responsibilities—were trained to go to specific sites during high intensity storms and prepare written notes and take photographs documenting what occurred.

Tuning Up Pre-Emergency Planning and Emergency Response. After the 2006 and 2007 storms, drainage managers at SPU decided the utility needed a more regularly-updated list of the locations in the city that were most vulnerable to flooding. Staff from across the utility—planners, engineers and field crews—now convene after every storm season to revise this so-called dynamic hot spot list, and continue improving their understanding of the types of storms that are of the greatest concern at each site (e.g. some spots flood during short, intense rain events; others during steadier, longer storms).

The updated hot spot list becomes a foundation for more strategic hazard mitigation and response planning. Sometimes, expensive retrofits of drainage infrastructure are needed, and little can be done in the short-term. In many cases, though, a simple increase in pre-storm maintenance, or a low-cost structural fix, such as building a redundant inlet, can significantly ameliorate the problem. Utility staff have also created a set of customized emergency procedures for each location. Each year, drainage managers brief SPU’s director about the hot spot list and the work being done at each location, elevating the attention to flooding at the highest levels in the organization.

Regional Communications. In the fall before each storm season, SPU jointly launches a multi-media educational campaign with many other nearby jurisdictions. A “Take Winter By Storm” website disseminates coordinated messages about the specific steps property owners can take to protect themselves and increase the resilience of their properties. Public service announcements featuring elected officials, and tips delivered by weather reporters during television weather forecasts also help educate residents about what they should do before and during storms.

Remapping Flood Prone Areas. In addition to raising the awareness of all Seattle residents about how to prepare for flooding, SPU wanted to bring more intensive public education to those neighborhoods where the risk of flooding is highest. To target its public outreach efforts in this way, SPU first needed updated maps of flood prone areas that took account of more recent data on precipitation and stormwater flows.
Integrating Climate Impacts into Capital Project Planning. “How climate change will affect flooding is not specifically known enough yet for us to make significant changes to our design standards for drainage projects,” says Gary Schimek, SPU’s Separate Systems Manager. In the meantime, though, SPU has made a push to increase consideration of flooding on a project-by-project basis. “We are trying to anticipate how new infrastructure will be affected when flooding does occur,” explains Schimek. “And we are looking at whether we can build individual projects for bigger storm events without substantially increasing our cost.”

New Orleans Recovery and Redevelopment

Addressing the scale of damage in New Orleans after Katrina has been no small challenge, but today the city has a state-of-the-art comprehensive master plan that will shape growth and development for the next 20 years. The plan promotes compact, mixed-use, energy efficient, neighborhood-oriented development, improved transportation, and many other strategies to support its three pillars of livability, opportunity and sustainability. Most importantly, the plan squarely addresses the main adaptation challenge for the city: its vulnerability to climate change and sea level rise, and the need for better protection from storms and flooding.

The plan recommends preparing for climate change by adopting standards and techniques to increase resilience, and by engaging the community in dialogue about risk and mitigation options. It also adopts a strategy referred to as “multiple lines of defense”—an integrated approach to flood control that calls for restoration of Louisiana’s coastal wetlands and other natural barriers, and structural strategies, such as levees. In a departure from the past, however, the plan also advocates learning to live with water, transforming it to an asset and integrating it in the urban landscape through canals and green infrastructure.

Community Based Adaptation and Mitigation in the Lower 9th Ward. In the wake of the storm, when the city’s planning process and resources remained at best unclear, many individual neighborhoods proceeded to develop their own recovery plans with the encouragement of the mayor. The Holy Cross district in the devastated Lower 9th Ward was one of those neighborhoods. Less than a year after the storm, the Holy Cross Neighborhood Association (HCNA), in partnership with Tulane University and other neighborhood organizations produced a sustainable restoration plan for the entire Lower 9th Ward. The resident-led effort represented the type of new civic engagement that is creating neighborhoods that are on the forefront of sustainability. The plan addressed four areas: urban design and the built environment, the economy, the environment and quality of life.

Architectural Innovations to Create Safe Affordable Housing. Developers and nonprofit organizations are building sustainable and affordable architectural model homes throughout the city. The houses incorporate high design elements (which have gotten a somewhat mixed response from area residents), as well as features that will make them safe, affordable and sustainable for low-income residents. The homes are modern, colorful and compact, using existing narrow lots. Taking a practical approach, the houses were elevated and built with accessible roofs for easy escape and rescue in the case of extreme flooding. One is a floating house—the first in the U.S.
For More Information

ISC’s 2010 Case Study on Tucson & Seattle Water Utility Planning:

ISC’s 2010 Case Study on Seattle’s Flood Risk Management:

ISC’s 2010 Case Study on New Orleans Redevelopment:
Implementing Green Infrastructure Approaches to Asset Management

In contrast to traditional “pipe to pond” stormwater systems designed to move water rapidly from paved surfaces, through pipes, and into retention ponds, catchment basins and other collection areas, green infrastructure systems promote a city’s natural ability to absorb stormwater where it falls. As such, green infrastructure design can augment community resilience by protecting lives and assets from flooding, re-charging local ground water supply, and mitigating urban heat island effect. Other co-benefits include decreased pollution, increased quality of life and property values and, in most cases, lowered installation and maintenance costs over the life of a project.

Background

Green infrastructure design reduces the total water flowing into natural and manmade waterways and maximizes opportunities for natural, on-site groundwater recharge. It represents a holistic method of stormwater management that integrates site-specific design elements—such as green roofs and walls, permeable pavers, bioswales, and vegetated parks and green spaces—cross an urban area. Addressing stormwater through this approach addresses challenges that span both the fundamental aspects of localized climate impacts—increased heat, and changes to the hydrological cycle.

Emerging Approaches

In recent decades, communities across the U.S. have begun to re-evaluate traditional development patterns in floodplains and coastal areas in an effort to reduce potential losses and reconstruction costs associated with maintaining assets subject to repeated flood events. These properties become green space in perpetuity and often provide a variety of public amenities, particularly for recreation, such as urban wildlife viewing locations, sports fields, and fitness trails. The Rivers Oaks Park Preserve in Fort Lauderdale, FL, is an example of this approach. The 9-acre parcel east of Interstate-95 had been on track for residential development prior to the economic collapse of 2008, but was restored to a natural wetland/stormwater management preserve in an effort to mitigate flooding impacts of adjacent neighborhood properties.

In the case of drought-prone regions, green infrastructure design can work to increase the long-term quantity and quality of local sources for water provision, both by helping replenish groundwater capacity and decreasing demand on water resources. In Tucson, AZ, planning department staff are working to implement sustainable land use codes. Careful to avoid increased mandates, they’ve added flexibility by presenting a menu of adjustments that increase compact, low-carbon and resilient development patterns. The code revisions include clauses encouraging developers to modify designs by incorporating permeable pavement and native plant species in their building and landscaping design, but also take on harder to tackle issues by attempting to increase opportunities for mixed use.
In addition to preventing pollution from stormwater, green infrastructure can reduce excessive heat conditions that originate from dark-colored, hardscape surfaces in urban environments that absorb heat, and then radiate it back to the environment. Known as “urban heat island effect,” this phenomenon causes temperatures to rise 10–15 percent in highly urbanized landscapes when compared to surrounding non-urban regions. Green infrastructure provides more permeable, green spaces, which increase shade and cooler surfaces that don’t re-radiate high levels of heat. As temperatures rise due to climate change, these green spaces will create an important buffer to extreme heat conditions. In the images below, a green roof installed on Chicago’s City Hall, measures only 74˚F on a sunny summer day, while the temperature radiating from the blacktop of an adjacent building is almost double that.

Traditional water collection infrastructure has historically contributed significantly to the challenge of “non-point” source pollution across the U.S.—that is, pollution of wetlands, rivers, and streams that originate across the landscape as opposed to coming from a single location, or “point,” on a map. Chemicals from fertilizers, livestock waste, oil from vehicles, and other byproducts of human activity are carried into aquatic ecosystems along with stormwater runoff. In addition, combined sewer overflow systems—in which the same networks of pipes collect stormwater as well as domestic sewage—can overflow during storm events and discharge effluent into waterways. It is estimated that nationwide, pollution from stormwater has caused unsafe conditions for swimming or fishing in roughly 13 percent of rivers, 18 percent of lakes, and 32 percent of estuaries,1 but these numbers are expected to increase as storm events become more frequent and/or severe as a result of climate change. Successful green infrastructure systems decrease the total volume of stormwater discharged through pipe systems, thereby reducing non-point source pollution levels and can even treat pollution on-site by filtering pollutants through natural systems.

Finally, green infrastructure features provide more hospitable urban environments, increasing natural habitat and wildlife, and the number of community gathering spaces. This can add to overall quality of

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life in urban spaces and increase community cohesion, which is an indispensible asset for disaster resilience.

In general, green infrastructure costs less to install and maintain than traditional stormwater infrastructure. Yet, making the case for green infrastructure can be difficult since techniques are often new to developers and stormwater utilities/managers, and the benefits are largely externalized (i.e., runoff pollution rarely affects individual sites directly).

However, the costs of constructing and maintaining traditional infrastructure systems—estimated to have exceeded $105 billion in 2008—are high, and the field is getting the attention of community planners and utility managers. To help make the economic case for green infrastructure, the EPA has provided a list of cost analysis tools and resources. One cited resource—the Center for Neighborhood Technology’s “Green Values National Stormwater Management Calculator”—compares the performance, costs, and benefits of green infrastructure practices to traditional approaches. This online calculator allows users to customize the tool based on their local environmental conditions and runoff volume goals, and choose green infrastructure strategies that best meet their environmental and economic needs.

Another resource cited by the EPA is the American Rivers document, “Local Water Policy Innovation: A Road Map for Community-Based Stormwater Solutions.” The document helps practitioners navigate local political landscapes to gain support for green infrastructure policies and programs. It then provides a step-by-step guide to developing a customized and comprehensive local regulation or policy supported by developers, government officials, and the community at large.

The Opportunity

Green infrastructure is likely to become more common as a cost-effective climate adaptation strategy because it restores urban environments' natural ability to self-regulate stormwater and reduce heat impacts. In addition, green infrastructure projects reduce urban blight by introducing natural beauty to urban environments, which is a critical approach to increasing quality of life and fostering greater community ownership and cohesiveness. In many ways, green infrastructure strategies are more effective than traditional engineered approaches because they take advantage of the ability of natural water cycles to absorb and purify stormwater, rather than artificially channeling stormwater to waterways.

Written by Nathaly Agosto Filión and Michael Crowley, Institute for Sustainable Communities

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For More Information

Several organizations across the United States are helping practitioners advance green infrastructure projects:

- The Environmental Protection Agency’s Green Infrastructure Program offers a comprehensive set of tools, research, case studies, and technical assistance grants to help communities advance green infrastructure programs.
- The Conservation Fund has a green infrastructure program that offers a peer-to-peer exchange program, webinars, and hosts an active “community of practice,” that links practitioners from across the country.
- The Green Infrastructure Center helps local governments, communities, regional planning organizations, and land trusts and developers evaluate their green infrastructure assets and make plans to conserve them. They offer workshops, technical assistants, and a series of reports and tools.
- The Green Infrastructure Foundation promotes greater awareness and resources to increase green infrastructure projects in communities. They offer a “Living Architecture Academy,” and a series of courses, webinars, and resources.
- The Center for Green Infrastructure assists communities and municipal agencies implement strategies and techniques to meet their green infrastructure goals. They offer staff expertise and toolkits.
CASE STUDY: FLAGSTAFF, ARIZONA

Flagstaff’s City Wide Resiliency Study
Internal Focus and Forgoing a Plan Allows for Quicker Results

Background Information

The city of Flagstaff recently completed a comprehensive Resiliency and Preparedness Study—concluding more than a year of work—that will help them prioritize their municipal service delivery investments for climate adaptation and resiliency into the future. A diverse city team conducted a thorough analysis and developed key recommendations for the city’s emergency services, energy systems, forest health, public health, stormwater, transportation, and water systems that were identified to be vulnerable and at risk from climate variability. The city’s approach, including focusing specifically on resilience in city operations and forgoing the development of a separate, stand-alone climate action or adaptation plan, are two things that city officials argue make this a longer lasting, better integrated, and efficient project to begin implementing.

According to the study, over the past two years, “...Flagstaff has experienced record warming, severe winter storms, record low moisture, catastrophic wildfires and subsequent flooding events.” The city’s ongoing commitment to community sustainability and experience with recent severe weather events and climactic changes is partially what has led them to embrace climate adaptation and management early on. The Resiliency and Preparedness Study is the city’s first step towards understanding the organization’s capacity to respond to projected impacts of a changing climate and ultimately improving their preparedness and prevention efforts.

The city’s sustainability specialist, Stephanie Smith, said of the effort, “Building local resiliency within the municipal organization serves as an insurance policy against uncertainty and promotes...”

“...To develop an organizational culture of resiliency, you have to be prepared to take risks and learn as you go.”

- Stephanie Smith
continued prosperity for the city of Flagstaff. The Resiliency and Preparedness Study supports the notion that a resilient local government builds a foundation for a resilient community.”

### Process

**Being Designated as a “Climate Resilient Community.”** In the summer of 2010 Flagstaff was recognized by ICLEI’s Climate Resilient Community’s Program as one of the seven Inaugural Adaptation Communities chosen to receive individual technical assistance. Smith explains being chosen by ICLEI, “…was great because it recognized our existing commitment and efforts around building local resiliency, and our desire to do more.”

In February of 2011 ICLEI’s adaptation staff came to Flagstaff to beta test their vulnerability assessment methodology through a half-day workshop. Their visit prompted City Manager Kevin Burke to invite a wide array of city staff who wouldn’t have otherwise attended. Smith explains, “I’ve actually talked with other cities that are getting ready to start a vulnerability assessment and…I’ve conveyed to them the significance of the leadership he showed—stressing the importance of this issue and the opportunity for Flagstaff to test the methodology—it was really beneficial to have him be that initiator for that first meeting.”

The workshop highlighted not only the importance of adaptation and resiliency planning, but also brought to light Flagstaff’s opportunity to make a difference in the way that the city equipped and prepared itself to manage their response and recovery to disasters and other climate impacts. While the half-day workshop allowed only a cursory assessment of a few areas of vulnerability, it helped create the foundation for the full scale, organization-wide study.

**Defining the Core Team.** After the workshop Smith began working closely with the City Manager to put together a core team of internal city staff and stakeholders from outside agencies, including the county emergency manager, a local representative from the National Weather Service, and a public health manager charged with emergency preparedness for the county’s public health services district. Internal city staff on the core team included the city’s Deputy Fire Chief, Wildland Fuels Manager, Economic Development Manager, Finance Director, Planning Director, Police Chief, Public Works Director, Risk Manager, Stormwater Engineer, Utilities Director, Sustainability Manager, and Stephanie Smith, Sustainability Specialist who manages the city’s climate resiliency and preparedness efforts.

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**FLAGSTAFF’S SEVEN PRIMARY SYSTEMS AT RISK FROM CLIMATE VARIABILITY**

<table>
<thead>
<tr>
<th>PRIMARY SYSTEM</th>
<th>KEY PLANNING AREAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Services</td>
<td>Police and Fire Services, EMS, Disaster Response, Public Works</td>
</tr>
<tr>
<td>Energy</td>
<td>Energy Delivery and Assurance, Energy Demand and Cost</td>
</tr>
<tr>
<td>Forest Health</td>
<td>Forest Management, Wildlife and Vegetation, Public Infrastructure</td>
</tr>
<tr>
<td>Public Health</td>
<td>Public Health Infrastructure, People, Public Services</td>
</tr>
<tr>
<td>Stormwater</td>
<td>Buildings, Infrastructure</td>
</tr>
<tr>
<td>Transportation</td>
<td>Public Transportation, Transportation Infrastructure, Public Access, Rail, Airport</td>
</tr>
<tr>
<td>Water</td>
<td>Water Treatment Quality, Water Resources, Water Infrastructure</td>
</tr>
</tbody>
</table>
The first meeting of the core team began with scoping the concept of vulnerability and risk from climate change to city operations. At this early stage, adaptation and resilience were relatively new topics for staff. Explains Smith, “It was something different and required taking the time to talk about the project, and not just meeting as a group, but also conducting individual meetings and work sessions. But we always determined the vulnerability and risk assessment results as a group.”

To kickstart their scoping process the team reviewed a recent report published by the Western Adaptation Alliance and ICLEI in 2011 that highlighted temperature and precipitation projections for the region into the future. Using a consensus-building process, the team identified seven primary systems (see box above) that were at risk and how they were connected specifically to city services and operations. Within each of the seven primary systems the team further identified 22 key planning areas. For example, within the primary system of emergency services are the ‘key planning areas’ that include police, fire, EMS, disaster response and public works. Furthermore, the core team assessed over 100 elements within those 22 critical areas of city operations.

**Analyzing vulnerability and risk in key city functions.** To conduct the analysis of each system and its associated key planning areas Smith adapted methodologies and studies done by other cities to identify the risk assessment and vulnerability assessment methodology that would work best for Flagstaff. She and the core team used vulnerability rankings produced by ICLEI to coarsely determine high or low vulnerability for each of the 22 key planning areas of city operations, using the table below.

<table>
<thead>
<tr>
<th>Adaptive Capacity Low → High</th>
<th>Sensitivity: Low → High</th>
</tr>
</thead>
<tbody>
<tr>
<td>S0</td>
<td>V2  V3  V4  V5  V5</td>
</tr>
<tr>
<td>AC0</td>
<td>V2  V3  V4  V5  V5</td>
</tr>
<tr>
<td>AC1</td>
<td>V1  V2  V3  V4  V5</td>
</tr>
<tr>
<td>AC2</td>
<td>V1  V1  V2  V3  V4</td>
</tr>
<tr>
<td>AC3</td>
<td>PO  V1  V1  V2  V3</td>
</tr>
<tr>
<td>AC4</td>
<td>PO  PO  PO  V1  V2</td>
</tr>
</tbody>
</table>

Table: Vulnerability Ranking

Sensitivity (S) and adaptive capacity (AC) levels were placed in a scoring matrix to provide an overall vulnerability (V) score of potential opportunity (PO) up to 5 with higher scores denoting greater vulnerability. If a planning area has a low sensitivity to climate change and has a high adaptive capacity, the planning area is of low vulnerability. Conversely, if a planning area has a high sensitivity to climate change and a low adaptive capacity, its vulnerability is high. Image credit: Flagstaff Resiliency and Preparedness Study

To increase the team’s clarity on Flagstaff’s vulnerability, they conducted a two step process. First, they underwent a sensitivity analysis for each key planning area in which, according to Smith, they “laid everything on the table to see what could happen.” This was meant to assess how weather and climate currently affect the particular city operation and the magnitude of possible impacts. Next, they assessed their adaptive capacity by looking at “…the city’s ability to accommodate or adapt to the impact given the city’s existing economic, natural, institutional and community resources.” Smith refers to this step as, “How prepared are we?”
The sensitivity analysis and adaptive capacity assessment together helped to inform a ‘vulnerability ranking’ more finely tuned to Flagstaff. In addition, the core team decided to conduct a risk assessment estimating the severity and likelihood a given climate change impact was expected to have on each of the key planning areas. The degree of impact was estimated by considering the size of the affected population, whether the impact could be life threatening and the estimated costs associated with the impact. The collective vulnerability and risk rankings have helped the core team to prioritize policy, program, and infrastructure investments.

**Where it Stands.** Now complete, the Resiliency and Preparedness Study’s results conclude with seven policy recommendations brought by the core team to the city council for adoption. In June 2012 the city council unanimously approved the seven policy statements, which Smith describes as, “essentially a commitment to prioritize and integrate resiliency throughout city decisions, operations and processes.”

<table>
<thead>
<tr>
<th>SEVEN GUIDING POLICY STATEMENTS ADOPTED BY FLAGSTAFF CITY COUNCIL RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy 1: That the City of Flagstaff will build, sustain and leverage partnerships with local and regional stakeholders to ensure collective investment, efficient action and shared responsibility in the building of local resiliency.</td>
</tr>
<tr>
<td>Policy 2: That the City of Flagstaff will consider the exacerbation of impacts to City operations when weather is combined with the circumstances of an aging and growing population as well as differential exposures to pollution, poverty and access to resources.</td>
</tr>
<tr>
<td>Policy 3: That the City of Flagstaff will institutionalize incremental resiliency within City operations by ensuring that key operational decisions integrate resiliency.</td>
</tr>
<tr>
<td>Policy 4: That the City of Flagstaff will take into account design and economic elements along with weather extremes in City planning for new development and supporting existing development needs.</td>
</tr>
<tr>
<td>Policy 5: That the City of Flagstaff will prioritize proactive education within City operations as a means to build individual, organizational and community resiliency to weather impacts and climate related disasters.</td>
</tr>
<tr>
<td>Policy 6: That the City of Flagstaff will develop comprehensive criteria that incorporate City priorities including resiliency into all City planning efforts.</td>
</tr>
<tr>
<td>Policy 7: That the City of Flagstaff will allocate, as appropriate, municipal resources necessary to adapt City operations to weather, including evidence based ongoing assessment of the City’s vulnerability and risk to climate variability.</td>
</tr>
</tbody>
</table>

Currently the core team is working to implement these policies in four main ways. First, the concepts of resiliency and preparedness and their associated new policies need to be introduced to the broad audience of the entire city staff and stakeholders. Second, the core team is identifying immediate ways they can integrate these policies into the most vulnerable and at risk city operations. Knowing that the city cannot accomplish all the study’s results and recommendations at once, the core team has prioritized water, emergency services, forest health, and energy for their initial focus. Within these priority areas the team is looking at what planning is already occurring that could incorporate portions of the study. For example the city-run water utility department is already including portions of the study’s recommendations in their newly updated plan. The core
team and the city council are also working to ensure that these new adaptation policies are complimentary with existing policies, specifically with current updates taking place with the comprehensive plan.

Third, the core team is working on determining performance benchmarks to ensure the policy is implemented and that the implementation is measured. Specifically they are looking at how adaptation planning might be incorporated into the city’s annual budgeting process. Said Smith, “Many determined vulnerabilities and risk have a budgetary impact so we are exploring the budgeting process as place for performance measurement and policy integration. What we don’t want is for this to be an extra burden for City departments.” Fourth and finally, in order to build a culture of resiliency amongst city staff, the team is pursuing both individual and organizational education and training. While individuals are trained on how to be prepared for specific emergencies, organizational trainings focus on specific processes and procedures that ensure the Council-adopted policy is accounted for and properly implemented.

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**Lessons Learned**

*The Power of Leadership.* Having the leadership of their city manager from the beginning, emphasizing the importance of this issue, was extremely valuable to this process and is something Smith continues to recommend to other cities looking to begin adaptation and resiliency planning projects.

*Follow a Team Approach with Broad Representation.* The consensus based process Flagstaff implemented created buy-in from a diverse array of internal and external stakeholders on the team. In addition it was critical that the core team was engaged on ‘the ground floor’ of the project, which gave them a sense of ownership over the process and eventually the policy and its implementation. The approach also lent a sense of open participation. Smith said, “The team had a great skill set for out-of-the-box thinking and they all participated no matter what the topic. For instance we had our Police Chief talking about water as well as our Utilities Director, so they all engaged on the issues.”

*The Benefits of Not Creating a Plan.* By not creating a separate plan the city could get to work with implementation much faster and start doing things rather than planning them. This approach also helped them consider ways of integrating adaptation into existing city processes. According to Smith, “there are existing policies within human resources, the fire department or the city water department that these resiliency and preparedness policies can help substantiate and be mutually supportive of.”

*Focus Internally on Things You Can Control First.* Choosing to focus this effort on city operations allowed the city to quickly build capacity and competency in uncharted territory with city staff from multiple departments. This competency created momentum and helped them achieve buy in from elected leaders of the city council. Said Smith, “Focusing internally allowed our city council to easily act, because it was impacting what we do. It is a lot easier to adopt strong policy statements that impact internal operations.”

*Get Out of Your Office.* Having an “all hands on deck” approach with the utilities director talking about emergency response and the police chief considering the public safety implications of water shortages allowed the team to think deeper and broader about weather and climate from multiple perspectives.
Adapt the Process as You Go Along. Originally the core team set out to complete a vulnerability assessment and to adopt a climate adaptation and management plan for the community. As they began working through the process they changed course several times. First in order to build additional depth into their study they decided to include a risk assessment. They also decided to abandon the idea of implementing a plan in favor of focusing energy on the creation of city policies that could quickly allow for the integration of adaptation planning beginning within city operations. Smith said, “I have many plans that sit on my shelf. A colleague of mine calls them ‘credenza-ware.’ But the policies the city council adopted build a foundation for integrating resiliency and preparedness into city operations. Also, the time and resources that we saved in not creating a plan will go into ensuring these policies are made accountable and effective. Zoning in on what actions will meet your specific needs will really help you create great resiliency impact.”

Thanks to Stephanie Smith, Sustainability Specialist, City of Flagstaff

Written by Josh Kelly, Institute for Sustainable Communities

For More Information

To view the complete City of Flagstaff Resiliency and Preparedness Study visit www.flagstaff.az.gov/prepare

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Email: ssmith@flagstaffaz.gov
EMERGING ISSUE: PERFORMANCE MEASUREMENT

Measuring Performance of Adaptation Initiatives

Adaptation practitioners across the world have been challenged with finding clear, efficient and relatively inexpensive ways to measure, monitor and evaluate progress on the success or failure of climate adaptation strategies. Local government, nonprofit, and private sector officials alike have all had to ask themselves: What does successful adaptation look like? How can I measure progress toward “resilience?” The following Emerging Issue Brief highlights the issues city face in measuring progress and showcases a few approaches being used in U.S. cities to monitor progress on adaptation and resilience initiatives.

Background

As climate change policy has joined the repertoire of issues managed by local governments over the past two decades, practitioners have added appropriate performance measures into the management systems they use to assess process quality, cost effectiveness, and progress toward socially desired outcomes. Whether reported on “scorecards” on embedded within complex sets of “indicators,” climate change policies—particularly climate “mitigation” or emission reduction policies—have been rather easily measured, reported, and managed. Emission reduction policies have the virtue of a common and easily quantified output—tons of CO₂ equivalent abated—that can be roughly summed across many policy measures and many economies to yield global outcomes: the extent of climate forcing associated with one level of global emissions versus another. Options for abating emissions can be easily compared on the basis of cost per ton and performance against projections can be readily tracked through easily obtainable proxy information such as energy consumption or vehicle miles traveled. In short, performance management for climate change mitigation policy in both the public and private sectors has been easily and widely implemented within the U.S.

As the policy agenda has increasingly prioritized climate change adaptation in recent years, the demand for performance management tools related to adaptation has grown as well. But unlike climate mitigation, climate adaptation deals in units of risk, vulnerability, and stocks of adaptive capacity that are difficult to measure in a context of uncertainty driven by what we don’t know about the future. The timescales of climate change adaptation strategies operate over decades—it may take decades to determine whether the strategy implemented today was successful.

Despite the challenges, performance management for climate change adaptation is advancing by drawing inspiration, methods, and insights from a wide range of disciplines. Evaluation is a critical component of the policy learning process; the Obama Administration’s Interagency Task Force on Climate Change Adaptation included “Continuously Evaluate Performance” as a guiding principle and noted that, “[b]ecause of the uncertainties inherent in projecting future climate conditions, impacts, and responses, adaptation cannot be simply a policy or action that requires a one-time change. All adaptation plans must allow for a “feedback” mechanism…” This same idea is found in the fifth and final “milestone” of the Resilient Communities program. Administered by ICLEI – Local Governments for Sustainability, the program furthers the drive to, “monitor and reevaluate resiliency.”
While very much a work in progress, many are contributing their thoughts, research, and tangible examples from practice to inform performance management for climate change adaptation. The following outlines examples of what we’ve seen thus far.

**Emerging Approaches**

**Emerging Approach – Define the Objectives**

Program performance measurement requires first a clear articulation of goals and objectives. In a recent review of local climate adaptation plans, noted researcher Susi Moser told a recent National Academies of Science advisory panel that very few plans clearly articulated specific goals and objectives for the community’s climate adaptation efforts. After assessing vulnerabilities and risks, the plans went into strategies without clearly stating what outcomes those strategies were designed to address. Being clear about a community’s climate adaptation objectives is a vital first step in evaluating successes—and it can have profound effects on the strategies selected.

The City of New York clearly framed its climate adaptation objectives in the PlaNYC process as follows:

- Assess vulnerabilities and risks from climate change;
- Increase the resilience of the City’s built and natural environment;
- Protect public health from the effects of climate change;
- Increase the City’s preparedness for extreme climate events; and
- Create resilient communities through public information and outreach

These objectives serve not only to organize specific strategies and tasks within the initial adaptation planning document, they serve also as a means of organizing narrative updates on work that has progressed in the implementation phase. Each year, the city publishes a report that contains a narrative account of progress since the last report, upcoming milestones to complete by the end of the current administration, and overall status of implementation in terms of “completed” or “in progress.” These annual progress reports capture the status of the implementation process in simple terms making it easier to share with stakeholders throughout the city.

**Emerging Approach – First, Measure the Outputs**

Program performance measurement readily distinguishes between “outputs” and “outcomes.” Outputs are the unit of service delivery—the citizen served, the speeding ticket written, or the number of trees planted in a city to reduce urban heat island. Outcomes are the ultimate objectives we seek to achieve through a public policy—citizen satisfaction in public services, safer streets with fewer traffic fatalities, and lower ambient temperatures within the city core during summer heat waves. Outputs are nearly always easier and cheaper to measure than outcomes, but both are necessary to test a particular “theory of change” embedded within a public policy or program.

As an early step toward a performance management system, some cities are simply recording the outputs—an account of actions taken as called for by the jurisdiction’s implementation plan: the number of trees planted, the square footage of pervious pavement installed, and the number of
bioswales installed, to name a few examples. While practitioners are developing longer-term outcomes and determining how to easily and cost-effectively measure them over time, output measures can provide vital early information to managers on the pace of the implementation process, expenses incurred, and progress to date.

**Emerging Approach – Correlations can be Helpful**
The City of Chicago is lauded as an early actor in the U.S. climate adaptation field, having drafted a climate action plan that incorporated the need for mitigation and adaptation action from the outset. But, as the city moved forward on projects meant to build resilience against expected climate impacts, staff tasked with managing performance outcomes struggled with how best to do so. In 2011, the city received a grant which helped boost performance measurement. That work, led by Olivia Cohn, Climate Action & Sustainability Specialist with the Global Philanthropy Partnership and consultant to the city’s Office of Sustainability, aims to establish a set of adaptation performance indicators specific to Chicago. Says Cohn, “Adaptation is one of the hardest things to measure. To us, success is not necessarily about a very different Chicago, but about maintaining the vibrant city Chicago is now. We are tweaking variables in an adaptive way. For example, because we can foresee there will be more storms as result of climate change, we think about better managing water the right way, with more pervious pavement and more green infrastructure. It’s really about maintaining the success Chicago enjoys now and building on that—using adaptation as opportunity.”

Cohn also offers some concrete ways Chicago is considering measuring progress on climate adaptation efforts. She says, “It’s still more of an art than a science, but we’re looking for hard measures that can help us think about how we’re being successful on adaptation.” Although the strategy has not yet been operationalized, many staffers and partners have been engaged in structuring a measurement strategy that calls for the city to track three kinds of indicators that would paint a clearer picture of progress towards resilience. The approach requires staff to track observations of the impacts predicted during the city’s climate risk assessment process (such as the increased occurrence of extreme precipitation events). Observations are then paired with success in implementation of the actions deemed to address those risks and vulnerabilities (such as the installation of pervious pavement in alleys). Adaptation “success”, then, would presumably be evident in the third metrics category—improvements in trends around second-order consequences of climate impacts (such as basement flooding as a result of large storms).

Chicago’s Office of Sustainability describes the three measurement categories as follows:

1. **Occurrence of Climate Change Impacts.** By tracking how closely climate scenarios match predictions from the Climate Impacts Report, staff can improve their understanding of the actions needed. Indicators include: number of 100-degree days, number of 100-year storms, and average temperature of lake water.

2. **Progress Towards Climate Readiness Actions.** Having anticipated climate impacts through the assessment process, CCAP staff prioritized action items. This tracking activity seeks to understand the extent to which the city has accomplished implementation of climate readiness projects. Metrics for tracking might include: number of cooling centers established, and square footage of green roofs installed.
3. **Occurrence of Climate-Correlated Surveillance Accounts.** By incorporating measures on climate-related impacts, staffers expect to demonstrate how the city has increased its resilience to climate change. Measures include: extreme heat mortality rates and size of urban heat islands.

“We’re not necessarily saying *this* influences *that*, but rather, we hope that by presenting these metrics together, someone could draw a connection. By tracking this data year by year, we hope to be able to say, for example, ‘Yes, we did see more storms this year, but we also saw less basement flooding, as well.’ And that may be because we increased the pervious pavement next to at-risk homes,” explains Cohn. “There’ve been a lot of eyes on this approach, and many key stakeholders thinking it through, but we’re not yet at a point where we are measuring adaptation. Part of reason this is problematic—and an art as opposed to a science—is that there are so many other factors involved. But idea is to present data together.” Cohn believes staffers will begin acting on this monitoring and evaluation approach in 2013.

**Emerging Approach: Toward Adaptive Management Systems**

The City and County of Denver has long embraced a private sector model for measuring the performance of city operations toward sustainability goals. Denver’s Environmental Management System (EMS) is modeled on the ISO 14001 EMS standard developed in the 1990’s for complex organizations.\(^1\)

1. Minimize how an organization’s operations (processes etc.) negatively affect the environment (i.e. cause adverse changes to air, water, or land);
2. Help organizations comply with applicable laws, regulations, and other environmentally oriented requirements; and
3. Continually improve in the above.

Denver is the first city to externally certify its compliance with the ISO 14001. They recently were recognized for their hard work in this front by leading the category in environmental governance on Siemens’ “Green City Index” for the U.S. and Canada. According to Paul Schmiechen, EMS Manager for the City of Denver, this business management tool move staff from the vision by translating great ideas into action. The EMS is currently being used to help drive sustainability into day-to-day operations of the 26 departments across the city. Denver’s adaptation working group feels confident its EMS can be expanded to include monitoring and evaluation of adaptation-related activities. “This is good management—it’s not rocket science, but the hard thing is to apply it across the board, consistently, year after year.”

If successful, the Denver EMS model can offer a robust, management-oriented model for measuring, monitoring and evaluating adaptation performance over time.

\(^1\) [http://www.iso.org/iso/iso14000]
Continuing Emergence

As performance management for climate change adaptation continues to progress in these leading cases, it’s important to note that we can learn about successful climate adaptation planning initiatives and specific implementations from examining related fields. The emergency management field has produced several very rich case studies on community hazard and risk mitigation initiatives that have unfolded over many years. The University of Colorado at Boulder’s Ron Brunner very helpfully notes the value of such case studies as Tulsa, Oklahoma; Soldier’s Grove, Wisconsin and Napa Valley California.

Additional insights are coming to U.S.-based adaptation practitioners from efforts to integrate climate change adaptation into international development, a field that has prioritized monitoring and evaluation for many years. There is a growing literature of adaptation monitoring and evaluation guides available that can provide much insight for local government practitioners.

As is the case in other fields of endeavor, we need more cases from around the country in which local government officials take up the task of measuring the performance of their adaptation efforts. Through trial and error, experimentation, and the efforts of many minds from diverse backgrounds, the field will progress toward a more rigorous set of tools for evaluating and monitoring performance.

For More Information

To view the City of New York’s PlaNYC Progress Report 2012 visit:

To view slides from a presentation given by Denver’s Environmental Management Systems Manager, Paul Schmiechen, visit:
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General Resources

This list includes overall resources on climate change adaptation, including national and regional assessments, online portals and peer exchanges, and other useful background information.

SCIENTIFIC ASSESSMENTS OF RISKS & IMPACTS

1. Reports on Confronting Climate Change: Science, impacts, and solutions
   This webpage provides access to several reports in a series of in-depth reports on the potential consequences of climate change in several regions and states: the Midwest (IN, MN, MO, OH), Northeast (CT, MA, ME, NH, NJ, NY, PA, RI, VT), Great Lakes region, and the Gulf Coast. To find the relevant publication, search the page for the name of the state or region.
   Union of Concerned Scientists, 2007-2009
   Webpage ▶ http://www.ucsusa.org/publications

2. Regional Integrated Sciences and Assessments (RISA)
   This webpage provides access to all of the currently funded Regional Integrated Sciences and Assessments (RISA) program teams for three Western and four Southern regions. The regional teams support research that address complex climate sensitive issues of concern to decision makers and policy planners. Research areas include fisheries, water, wildfire, agriculture, public health, and coastal restoration.
   NOAA
   National Program Website ▶ http://www.climate.noaa.gov/cpo_pa/risa

3. Transportation and Climate Change Clearinghouse—Climate Change Impacts
   This annotated list of resources on the impacts of climate change on transportation infrastructure is continually updated.
   Department of Transportation, 2010

4. Climate Change Indicators in the United States
   This report gives an overview of climate impacts and 24 climate change indicators for the United States. The report uses visual tools to help readers interpret these indicators.
   Download ▶ http://www.epa.gov/climatechange/pdfs/climateindicators-full.pdf

5. Global Climate Change Impacts in the United States
   This report summarizes, in plain language, the science and the impacts of climate change on the United States by region, now and in the future. It provides an overview of impacts on various aspects of society and the economy such as energy, water, agriculture, and health.
   Download ▶ http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts

6. Why the Emergency Management Community Should be Concerned about Climate Change: A discussion of the impact of climate change on selected natural hazards
   This draft report outlines key climate change issues for consideration from an emergency management perspective and introduces potential implications for the near-, medium-, and long-term. It summarizes the current climate change literature, focusing on the estimated impacts on the location, frequency, and occurrence of natural hazards, such as tropical cyclones, wildfires, floods, and winter storms. It also
identifies related policy issues in the areas of disaster mitigation, preparedness, response, and recovery. Finally, it provides potential courses of action to support future dialogue among emergency management practitioners from all levels of government to explore policy solutions in greater depth.


ONLINE PORTALS AND PEER EXCHANGES

7. Adaptation Clearinghouse
This webpage tracks adaptation initiatives, searchable by location, resource type, sector or impact. The clearinghouse also includes a list of state and local adaptation planning efforts, and provides links and brief overviews.
Georgetown Climate Center, 2011
Download ‣ http://www.georgetownclimate.org/adaptation/clearinghouse

8. Climate Access website
This website supports a community of practice for communicators around climate issues—included within the website are case studies, a regular blog, and periodic webinars around effective climate communications. The site also hosts interactive features that enable online collaboration.
The Resource Innovation Group – Social Capital Project
Website ‣ http://www.climateaccess.org/

9. Climate Adaptation Knowledge Exchange (CAKE) website
This searchable website features: profiles of adaptation project case studies (over 100), information resources (over 300), a directory of people and organizations engaged in adaptation work, tools for decisionmakers, managers, and educators (40), and a community section including an international events calendar and advice column.
EcoAdapt and Island Press, 2010
Website ‣ www.cakex.org

10. Coastal Climate Adaption
This site includes a wide range of resources on climate change impacts and adaptation, and a forum for coastal state and local government officials. The list of resources is organized by topic area and state, and includes adaptation plans, action plans, case studies, strategies, guidebooks, outreach material, risk and vulnerability assessments, stakeholder engagement guides, and training and workshop materials.
NOAA, 2010
Website ‣ http://collaborate.csc.noaa.gov/climateadaptation/default.aspx

11. Climate Prep Blog website
This blog showcases climate change adaptation projects through compelling on-the-ground stories and tracking firsthand the progress of preparing for a changing climate at the national and international policy levels.
WWF
Website ‣ http://www.climateprep.org
12. Colorado Climate Preparedness Project website
In addition to the comprehensive climate adaptation report to the Colorado governor, the Western Water Assessment developed a companion website that includes listings for people, projects, products and organizations active in climate adaptation in the Western United States.

University of Colorado at Boulder – Western Water Assessment
Website → http://www.coloadaptationprofile.org

OTHER USEFUL BACKGROUND INFORMATION

13. Assessment of Climate Change Impacts on Local Economies
This report includes an overview of climate change impacts and actions in the Intermountain West: urban heat island and excessive heat events, urban water resources, flooding and floodplain development, ski resorts, national forests and parks, and ranching and farming.
Download → http://www.lincolninst.edu/pubs/1706_Assessment-of-Climate-Change-Impacts-on-Local-Economies

14. Climate Change 101: Adaptation
This report provides a summary analysis of climate change adaptation, providing an overview of the impacts expected across the United States, an argument for adaptation planning, and a series of successful strategies.
Pew Center on Global Climate Change, Jan 2011, 14pp.

15. Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Summary for Policymakers
This summary for policymakers presents key findings from the Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX). The SREX approaches the topic by assessing the scientific literature on issues that range from the relationship between climate change and extreme weather and climate events (‘climate extremes’) to the implications of these events for society and sustainable development. The assessment concerns the interaction of climatic, environmental, and human factors that can lead to impacts and disasters, options for managing the risks posed by impacts and disasters, and the important role that non-climatic factors play in determining impacts.

16. Coping with Global Climate Change: The Role of Adaptation in the United States
This report provides a strong overview of proactive adaptation approaches, including infrastructure planning and development, avoidance of “maladaptations,” and the role of public policy. It provides more detail on approaches to agriculture, water resources, and sea level rise.
Download → http://www.pewclimate.org/global-warming-in-depth/all_reports/adaptation

17. Good Morning, America! The Explosive U.S. Awakening to the Need for Adaptation
This report provides an historical overview of the public, political, and scientific concern adaptation in the United States. It describes the shift from the early concerns with climate change and adaptation to the more recent awakening to the need for a comprehensive approach to managing the risks of climate change. It challenges assumptions that developed nations like the United States face relatively low vulnerability
and possess high adaptive capacity to address climate change.


18. **Terrestrial Ecosystem Adaptation**

This report explores how ecosystems might adapt to climate changes over the next half-century, predicts that large parts of the United States will confront a range of weather-related problems—from insect infestations to wildfires, from melting permafrost to dried wetlands, and from incursions of invasive species to large-scale species extinction. Although its primary focus is on ecosystems, it also provides a map-based overview of heat, precipitation, and snow melt trends across the United States.

Adaptation Planning

This list includes climate change adaptation planning examples, more case studies, guidelines and tools.

EXAMPLES AND CASE STUDIES

19. **State and Local Adaptation Plans**
   This webpage tracks state and local efforts on adaptation planning, and provides links and brief overviews. Localities include Homer AK, Phoenix AZ, several cities in CA, Miami-Dade County FL, Alexandria VA, King County WA, and Milwaukee WI.
   **Georgetown Climate Center**, 2010
   Download ▶ http://www.georgetownclimate.org/adaptation/adaptation-plans.php

20. **Preparing the Pacific Northwest for Climate Change: A framework for integrative preparation planning for natural, human, built and economic systems**
   This report provides a framework for adaptation planning in Oregon which can help other areas think through components of their plans and how to integrate them.
   **Climate Leadership Initiative, University of Oregon**, 2008
   Download ▶ http://www.theresourceinnovationgroup.org/storage/Preparing_PacNW_for_Climate_Change_4-2-08.pdf

21. **Cities Preparing for Climate Change: A study of six urban regions**
   This report incorporates the lessons learned from six “early adopters”—London, New York, Boston region, Halifax, Greater Vancouver, and Seattle and King County—and addresses these experiences by phase of the adaptation planning process.
   **Clean Air Partnership**, 2007
   Download ▶ http://www.cleanairpartnership.org/pdf/cities_climate_change.pdf

22. **Implementing Climate Change Adaptation: Lessons Learned From Ten Examples**
   This report provides practical examples of adaptation planning and implementation from cities and counties across the U.S., including Boulder (CO), Chicago (IL), Chula Vista (CA), Eugene (OR), Keene (NH), Miami-Dade County (FL), New York City (NY), Olympia (WA), Portland (OR) and Taos (NM) and reports on lessons learned.
   **Headwaters Economics**, Feb 2012

ADAPTATION PLANNING GUIDELINES

23. **Preparing for Climate Change: A Guidebook for Local, Regional and State Governments**
   This guidebook describes a step-by-step process for achieving a set of climate change preparedness milestones within the context of municipal planning, based on ICLEI’s five milestone process. For more information see the Resource Snapshot earlier in this Resource Guide on page 18.
   **University of Washington’s Climate Impacts Group, King County Washington, and ICLEI**, 2007, 186pp.
   Download ▶ http://cses.washington.edu/cig/fpt/guidebook.shtml
24. **Center for Climate Strategies Adaptation Guidebook**
   *This guidebook offers a step-by-step process to help agencies develop climate change adaptation plans at the state, local, or regional level.*
   **Center for Climate Strategies**, Sept 2011, 124pp.
   To request a copy of the guidebook, email info@climatestrategies.us

25. **Objective Setting for Climate Change Adaptation Policy**
   *This guide presents an iterative process for setting objectives in climate change adaptation planning and implementation. It also describes how the model was applied by Defra (UK’s Department for Environment, Food, and Rural Affairs) to generate ‘strawmen’ objectives and targets. This methodology can help other regions systematically think through and prioritize their own objectives.*

26. **The Mitigation-Adaptation Connection: Milestones, Synergies and Contradictions**
   *This primer briefly describes an approach for integrating adaptation into mitigation planning, and provides several examples, by sector, of how mitigation and adaptation actions can be synergistic, and how they may be contradictory.*

27. **Identifying Adaptation Options**
   *This guide includes a framework for identifying and selecting adaptation options.*
   Download ▷ [http://www.ukcip.org.uk/wordpress/wp-content/PDFs/ID_Adapt_options.pdf](http://www.ukcip.org.uk/wordpress/wp-content/PDFs/ID_Adapt_options.pdf)

28. **Climate Adaptation: Risk, uncertainty and decision-making**
   *This report provides an 8-stage decision-making framework for examining and choosing among available adaptation options. This framework is most appropriate for decision makers who have some knowledge of climate risks, but who want to better understand them and their adaptation options.*

29. **Community and Regional Resilience: Perspectives from hazards, disasters, and emergency management**
   *This research paper outlines: what makes people and places vulnerable, including location, infrastructure and economic factors; what makes communities resilient, including recognizing and understanding hazards and planning for disaster recovery, planning and land use and development; and barriers to planning for resilience. It also reviews possible measurement and indicators for resilience and some frameworks for community resilience assessment.*
   Susan Cutter et al., **Community & Regional Resilience Initiative (CARRI)**, 2008, 33pp.
30. **Adapting to Climate Variability and Change: A guidance manual for development planning**
   This guidance manual provides through a 6-step process for incorporating vulnerability and adaptation into project design. Although developed for USAID’s grantees, the guidelines are readily transferable to other project managers seeking to account for climate hazards.

31. **Urban Flood Risk Management: A tool for integrated flood management**
   This tool guides practitioners on flood management and includes information on various types of urban flood hazards, impacts of flooding in cities, risk assessment and management, and a framework for flood risk management. The tool also discusses integrating flood risks in urban planning, surface water management plans, and participatory planning.

**ADAPTATION PLANNING TOOLS**

32. **UKCIP Adaptation Wizard**
   This web-based tool guides users through a 5-step adaptation planning process and provides relevant resources for each step, including how to identify vulnerabilities to climate change and how to identify ways to reduce vulnerability. It is designed for use by a wide range of audiences new to climate change adaption, and it provides a structure for planning and awareness-raising.
   UK Climate Impacts Programme, 2010
   Webpage ➤ http://www.ukcip.org.uk/wizard/

33. **Planning for Climate Change: Customizable Workshop Materials**
   The customizable workshop was developed for planners and coastal decision makers. Piloted in two locations in 2009 in Washington State, the materials, including all PowerPoints and streaming videos, are available on the website, and can be used as a roadmap for engaging planners and decision makers. The materials are grounded in science and focus on actions to prepare for and adapt to impacts of climate change.
   Coastal Training Program, National Estuarine Reserve System, 2009

34. **Local Government Climate Change Adaptation Toolkit**
   This toolkit includes a 68-page comprehensive manual providing a conceptual framework for adaptation and step-by-step instructions for 14 tools geared towards different stages of adaptation planning. The tools are also available for download from this page, including a planning workshop template, stakeholder identification worksheet, barriers document, and risk assessment scenario worksheet. The tools were piloted with 5 Australian communities prior to the toolkit’s release in 2008.
   ICLEI and Australia’s Department of Climate Change
35. Climate Adaptation Starter Kit
The toolkit includes EcoAdapt’s top resources, tools and adaptation examples. It includes resources for assessing climate change vulnerability, risk and impact; processes to guide the development of adaptation strategies; a sampling of climate adaptation portals, tools and resources; adaptation case studies; a guide to getting started on adaptation planning and tips for evaluation and monitoring of adaptation programs.

EcoAdapt
Risk Assessments

This list includes resources on risk assessment, including examples, guidelines, and tools. Note that these resources use different terminology for aspects of a risk assessment, and that they may cover different portions of the process.

EXAMPLES

36. Climate Change Adaptation in New York City: Building a risk management response
   This webpage provides access to New York City's risk assessment by chapter. The information and recommendations are relevant to other cities, and could serve as a template for other city risk assessments. Content includes: how and why New York City might adopt a risk-based approach; infrastructure impacts and adaptation challenges; a review of the range of current environmental laws and regulations for their applicability to climate change adaptation efforts; the role of the insurance industry; and recommendations for a monitoring program. The appendices include three workbooks to guide a climate change adaptation planning process: “Climate Risk Information” related to risks to critical infrastructure, “Adaptation Assessment Guidebook” which outlines a stakeholder process, and “Climate Protection Levels” which evaluates policies.
   New York City Panel on Climate Change, City of New York, NY; Annals of the New York Academy of Sciences, May 2010
   Webpage » http://www3.interscience.wiley.com/journal/123443047/issue

37. Corporate Risk Case Study: City of Chicago Climate Change Task Force
   This document reports the results of a Corporate Risk case study modeled for City of Chicago’s municipally-controlled assets. Although it does not provide information on the proprietary methodology used, it does show output that can be obtained by such an analysis, which may be useful to others considering whether to undertake such an analysis.

38. Adapting to Climate Change: A Risk-based Guide for Local Governments
   This guide argues for a risk-based approach to adaptation planning and outlines the process for risk management. It also highlights climate trends and projections in Canada and has an appendix that discusses risk communications and perceptions and how to talk to the public about risks.

40. Regional Climate Change Effects: Useful information for transportation agencies
This report provides the transportation community (including highway engineers, planners, NEPA practitioners) with digestible, transparent, regional information on projected climate change effects that are most relevant to the U.S. highway system. This information informs assessments of the risks and vulnerabilities facing the current transportation system, and can inform planning and project development activities.

Federal Highway Administration, 2010
Webpage ➤ http://www.fhwa.dot.gov/hep/climate/climate_effects/effects00.cfm

41. CalAdapt/Google Earth Prototype
This website provides user-friendly, interactive visualizations of the effects of climate change on California, including climate data, sea level rise, wildfire frequency, and snow pack projections. Visualizations are in Google Earth, viewable online or in Google Earth software that can be downloaded for free. The visualization tools are still in prototype phase and have been developed with funding from the California Energy Commission and Google.org.

Stockholm Environment Institute, State of California
Webpage ➤ http://cal-adapt.org/

42. Shaping Climate-Resilient Development: A framework for decision-making
This comprehensive report provides concepts and tools for thinking about adaptation in terms of risk and how to assess that risk: risk to life, to communities, and to economies and livelihoods. It provides guidance on quantifying the risks of climate disruption, how to make an economic case for investing in resiliency, and how to prioritize adaptation projects. It draws on a number of case studies around the world.

Economics of Climate Adaptation, 2009, 164pp.

43. Best Practices Approaches for Characterizing, Communicating, and Incorporating Scientific Uncertainty in Climate Decision Making
This report is a tutorial for climate analysis and decision-making communities on current best practice in describing and analyzing uncertainty in climate-related problems.


44. Climate Change Impacts & Risk Management: A guide for business and government
Although the case studies upon which it is based are Australian, this guide can be used by elected representatives, general management, and risk managers elsewhere particularly in their beginning stages of assessment and prioritization. This guide is designed to assist businesses and organizations adapt to climate change and integrate climate change impacts into risk management and strategic planning activities. Case studies about a large private company, a public utility, a government agency and a local government illustrate a good risk management framework for managing increased risk to organizations due to climate change, and in particular the initial assessment and prioritization of risks.

45. **Vulnerability Assessment for Climate Adaptation**

This technical paper presents a structured approach to climate change vulnerability assessment. The paper recommends five tasks and suggests appropriate methods suitable for different levels of analysis. The five tasks link a conceptual framing of vulnerability to identification of vulnerable conditions, analytical tools and stakeholders.

Download › www.aiaccproject.org/meetings/Trieste_02/trieste_cd/Vulnerability/TP3_Downing.doc

46. **Assessing Vulnerability and Risk of Climate Change Effects on Transportation Infrastructure: Pilot of the conceptual model**

This webpage outlines a conceptual Risk Assessment Model that is being piloted by three to four State Departments of Transportation or Metropolitan Planning Organizations selected by the Federal Highway Administration (FHWA). FHWA will refine this draft conceptual model and develop a final version for all transportation agencies. The goal of the Risk Assessment Model is to help transportation decision makers (particularly transportation planners, asset managers, and system operators) identify which assets (a) are most exposed to the threats from climate change and/or (b) are associated with the most serious potential consequences of those climate change threats.

Federal Highway Administration, 2010

47. **Engineering Literature Review: Water resources – infrastructure impacts, vulnerabilities and design considerations for future climate change**

This review includes information on water infrastructure and climate change resource documents, impacts of climate change on water resources, and a summary, discussion and recommendations. Developed for a more adaptation-focused Canadian audience, this review can be a useful starting point for U.S. water managers seeking to assess their risks.

Download › http://www.pievc.ca/e/Appendix_C_Literature_Reviews.pdf

48. **Community Resilience: A social justice perspective**

This report provides a good, brief overview of the key social factors that make a community vulnerable and ways to bolster resilience.


**ASSESSMENT TOOLS**

49. **Community-Based Risk Screening Tool—Adaptation & Livelihoods (CRiSTAL)**

CRiSTAL is a project planning and management tool. Used at the community level to incorporate local knowledge about climate change and resource use considerations into development projects, it helps project planners and managers integrate risk reduction and climate change adaptation into projects. CRiSTAL uses a series of worksheets to guide users systematically through the climate change context of their project, the resources at risk, existing coping strategies, and possible project modifications to reduce project vulnerability to climate change. It is designed as an Excel Workbook, but can be used in hard copy. The Workbook and Users’ Manual are available in French, English, and Spanish.

Webpage › http://www.cristaltool.org/content/about.aspx
50. **Business Areas Climate Impacts Assessment Tool (BACLIAT)**  
*This tool provides a good starting point for exploring the implications of climate change for a particular business or sector and for municipalities who would like to engage the business sector in climate adaptation efforts. It is comprised of a simple checklist for assessing the potential impacts of climate change under generic business areas. It encourages the consideration of both threats and opportunities and is most effective when used as part of a group brainstorming exercise.*  
UK Climate Impacts Programme, 2010  
Website  ▶ http://www.ukcip.org.uk/bacliat/

51. **Climate Wizard**  
*This web-based mapping program allows non-technical as well as technical users to view historic and projected future temperature and rainfall maps around the world (with finer-scale data for the United States).*  
The Nature Conservancy, the University of Washington, and the University of Southern Mississippi  
Website  ▶ http://www.climatewizard.org

52. **Digital Coast/ The Coastal Risk Atlas**  
*NOAA’s Digital Coast provides data, tools, training, and examples for coastal communities that wish to address a specific issue and become more resilient. Launched in 2008, the Digital Coast is used to address timely coastal issues, including land use, coastal conservation, hazards, marine spatial planning, and climate change. One of the goals behind the creation of the Digital Coast was to unify groups that might not otherwise work together. It also provides information from the Coastal Risk Atlas.*  
NOAA, 2008  
Website  ▶ http://www.csc.noaa.gov/digitalcoast/

53. **NOAA Coastal Hazard Assessment Tool**  
*The Hazard Assessment Tool is an easy-to-use Internet mapping application that helps users identify the potential hazards that affect a location. It uses geospatial hazards data and supporting base data to identify hazards, and helps with planning and permitting. Once a location has been selected, the tool queries the hazards data to determine the hazards zone(s) for the location and provides supporting information to put the hazards information in proper context.*  
NOAA  
Website  ▶ http://www.csc.noaa.gov/hat
54. **HAZUS - FEMA’s Methodology for Estimating Potential Losses from Disasters**

HAZUS is risk assessment software for analyzing potential losses from floods, hurricane winds and other disasters. In HAZUS, current scientific and engineering knowledge is coupled with the latest geographic information systems (GIS) technology to produce estimates of hazard-related damage before, or after, a disaster occurs. Potential loss estimates analyzed in HAZUS-MH include: physical damage to residential and commercial buildings, schools, critical facilities, and infrastructure; economic loss, including lost jobs, business interruptions, repair and reconstruction costs; and social impacts, including estimates of shelter requirements, displaced households, and population exposed to scenario floods, earthquakes and hurricanes. HAZUS is available in DVD format for free.

**Federal Emergency Management Agency**

Climate Risks and Adaptation Strategies

This list includes catalogs of climate change adaptation strategies: comprehensive resources, and strategies by type: public health, heat, freshwater supply, severe storm/flooding, sea level rise, and built environment.

STRATEGIES FOR VARIOUS CLIMATE IMPACTS

49. Climate Change Actions for Local Governments
   This straightforward guide provides a large sampling of possible adaptation actions related to infrastructure, health services, natural resource management, water and sewerage services, and other areas. Descriptions, case studies, and examples are integrated together for easy reading. The guide was developed for Australia but it offers a useful starting point for U.S. cities.

50. Chula Vista Climate Action Planning - Climate Change Working Group
   This webpage provides access to several 'planning matrices' – tables of detailed adaptation options by topic, compiled by the City of Chula Vista in Southern California for its adaptation planning efforts. Impact topics include water, energy, public health, biodiversity, business, and sea level.
   City of Chula Vista, Department of Conservation and Environmental Services, 2010
   Webpage ▶ http://www.ci.chula-vista.ca.us/clean/conservation/Climate/ccwg1.asp

51. Hazard Mitigation Best Practices Search
   This database of best practice in disaster mitigation is searchable by location, sector type, hazard, type of activity, and keywords. Hazards include drought, severe storm, extreme temperatures, winter storm, and wildfire. Activities include building codes, outreach, floodplain management, land use/planning, community shelters, utility protective measures, vegetation management, and wetland restoration.
   FEMA
   Website ▶ http://www.fema.gov/mitigationbp

52. Compilation of 50 Programs for Use in Community Based Adaptation Projects
   This compilation presents model programs for addressing challenges in community based adaptation and participatory forest restoration projects. Programs represent the best programs being used successfully in the field today, in categories of water use management, forest restoration, livelihoods, agriculture and building community resilience.
   Center for Sustainable Development

DEVELOPMENT AND INFRASTRUCTURE

53. International Conference: Strategies for Adapting Public and Private Infrastructure to Climate Change
   This website presents a list of workshop materials for the international conference, “Strategies for Adapting Public and Private Infrastructure to Climate Change,” held in El Salvador, June 30-July 1,
2010. Resources useful to a U.S. audience include the workshop agenda, concept note, conference presentations, and publications related to the topic of climate proofing of infrastructure in the context of climate change adaptation and urban and regional planning.

**Adaptation Learning Mechanism**, Jul 2010
Website ▶ http://www.adaptationlearning.net/infrastructure-adaptation

54. **Adapting to climate change: A checklist for development**
   This checklist provides guidance on designing building developments to withstand a changing climate throughout their lifetime. The checklist covers issues such as water re-use and efficiency, reducing flood risk, avoiding overheating and minimizing damage from subsidence and heave.
   Download ▶ http://www.london.gov.uk/lccp/publications/docs/adapting_to_climate_change.pdf

55. **Adapting to Climate Change: A case study companion to the checklist for development**
   The companion guide applies the Checklist for Development’s guidance (above) and provides case studies of developments or buildings that incorporate adaptation in their design and construction. This guide provides replicable cases of buildings and developments that incorporated adaptation measures to increase resiliency to the changing climate. The case studies address climate change impacts, such as urban heat island effect and flooding, and they illustrate techniques relevant to key climate change adaptations issues, such as siting, site layout, ventilation, drainage, water, outdoor spaces and connectivity.

56. **ClimateSMART—Climate Change: Developer’s Risk Management Guide**
   This can serve as a model government guide for developers. It was created for developers of Halifax’s coastal, low-lying, urban/forest fringe, and rural areas. The guide includes an overview of climate change, describes the predicted impacts on Halifax relevant to development projects, provides a step-by-step approach to assessing the risk, and provides a checklist that can be used in the planning and evaluating of development proposals.

57. **Summary of Cost Benefit Evaluation of Ecoroofs Report**
   This consultant’s report presents cost and benefits of green roofs from the literature, including areas of stormwater management, energy, climate, habitat, amenity value, and building development. The total private and public costs were found to be $27,143 over a 5-year period, and the benefit to be $595,053 over a 40-year period.
   Download ▶ http://www.portlandonline.com/bes/index.cfm?a=261053&c=50818

58. **U.S. DOT Framework for Considering Climate Change in Transportation and Land Use Scenario Planning**
   This framework report from the U.S. Department of Transportation’s Research & Innovative Technology Administration provides an overview and lessons learned from a pilot project in Cape Cod, MA.
   Download ▶ http://www.volpe.dot.gov/coli/ppoa/publiclands/projects/docs/cape_cod_pilot_finalre
HEAT

59. Excessive Heat Events Guidebook
   This guidebook provides information that local public health officials and others need to begin assessing
   their vulnerability to excessive heat events and developing and implementing notification and response
   programs. Cost-benefit guidelines are also included.

60. Heat Island Effect
   This website provides access to EPA’s Urban Heat Island Community Actions Database, by state &
   locality, initiative type, and strategy. Initiative types include ordinances, building codes, and outreach
   programs; strategies include trees and vegetation, green roofs, cool roofs, and cool pavements. It also has
   resources such as outreach materials, a compendium of strategies, and a Mitigation Impact Screening
   Tool.
   EPA, last updated Aug 2010
   Website » http://www.epa.gov/heatislands/index.htm

61. Mitigating New York City's Heat Island with Urban Forestry, Living Roofs, and Light
    Surfaces
   This report includes a step-by-step cost-benefit analysis of the titular approaches to mitigating the urban
   heat island effect.
   Download » http://www.nys erda.ny.gov/Publications/Research-and-
   Development/Environmental/EMEP-
   Publications/~/media/Files/Publications/Research/Environmental/EMEP/06-
   06%20Complete%20report-web.ashx

62. Adapting to Urban Heat: A Tool Kit for Local Governments
   This analytic tool helps policy makers to consider a combination of four built-environment changes (cool
   roofs, green roofs, cool pavements, and urban forestry) and provides clear criteria for selecting among
   them, along with examining the roles government can play in pursuing these changes: shaping
   government’s own operations, mandating or providing incentives for private choices, and engaging in
   public education.
   Sara P. Hoverter, Georgetown Climate Center, 2012, 82pp.
   Download » http://www.law.georgetown.edu/academics/academic-programs/clinical-

NATURAL AREAS

63. Four Forest Restoration Initiative
   The overall goal of the Four Forest Restoration Initiative (4FRI) is to restore the structure, pattern and
   composition of fire-adapted ecosystems, which will provide for fuels reduction, forest health, and wildlife
   and plant diversity. A key objective is doing this while creating sustainable ecosystems and industries in
   the long term. Appropriately-scaled businesses will likely play a key role in the effort by harvesting,
   processing and selling wood products. The restoration-based work opportunities are expected to create jobs
across northern Arizona.

US Forest Service, accessed March 2012
Website ▶ http://www.fs.usda.gov/4fri

64. Climate, Fire, and Carbon Cycle Science

This website provides an overview of research science conducted by the Climate, Fire, and Carbon Cycle Science Research Work Unit of the U.S. Forest Service’s Northern Research Station. Their mission is to develop and provide the basic science, quantitative methods, and technology needed to make decisions about forest ecosystems and the atmosphere related to climate change, fire, and carbon.

Climate, Fire, and Carbon Research Work Unit, US Forest Service, last updated Oct 2010
Website ▶ http://nrs.fs.fed.us/units/climate/focus/climate_change/

65. Sky Island Alliance

Sky Island Alliance is a grassroots organization dedicated to the protection and restoration of the rich natural heritage of native species and habitats in the Sky Island region of the southwestern United States and northwestern Mexico.

Sky Island Alliance, 2011
Website ▶ http://www.skyislandalliance.org/

66. Landscape Conservation Cooperatives

Landscape Conservation Cooperatives (LCCs) recognize that these challenges transcend political and jurisdictional boundaries and require a more networked approach to conservation—holistic, collaborative, adaptive and grounded in science to ensure the sustainability of America’s land, water, wildlife and cultural resources. As a collaborative, LCCs seek to identify best practices, connect efforts, identify gaps, and avoid duplication through improved conservation planning and design. Partner agencies and organizations coordinate with each other while working within their existing authorities and jurisdictions. The 22 LCCs collectively form a national network of land, water, wildlife, and cultural resource managers, scientists, and interested public and private organizations—within the U.S. and across our international borders—that share a common need for scientific information and interest in conservation.

Department of Interior, accessed March 2012
Website ▶ http://www.doi.gov/lcc/index.cfm

PUBLIC HEALTH

67. Ready for Change: Preparing Public Health Agencies for the Impacts of Climate Change

This manual provides practical guidance to public health departments prioritizing and implementing operational changes that allow public agencies to prepare their employees and communities for climate change. Actions discussed include those that can be implemented immediately and at low cost, to those requiring long-term planning and funding. Additionally, it provides guidance for demonstrating and communicating a commitment to reducing risks and building resilience. Topics discussed are extreme heat, disease patterns, water, food, air quality, and mental health. Developed for Oregon but transferable elsewhere.

Climate Leadership Initiative, University of Oregon, May 2010, 43pp.
Download ▶ http://www.theresourceinnovationgroup.org/storage/PubHealthPrepManual5-10LR.pdf
68. **CDC Policy on Climate Change and Public Health**  
This statement summarizes some of the main public health risks and populations at risk for specific climate impacts. It also identifies eleven priority health responses, most of which point toward actions to be taken in the future.

Center for Disease Control and Prevention, 2pp.
Download ▶ http://www.cdc.gov/climateandhealth/policy.htm

69. **Environmental Health Primer**  
This primer provides a basic understanding of environmental public health concepts and principles to help local officials make better decisions. Geared to local boards of health but provides useful background information for other official audiences too. Chapters of relevance to climate adaptation include air quality (in Part 2), drinking water and wastewater (Part 3), and vector control (in Part 4).

National Association of Local Boards of Health, National Environmental Health Science and Protection Accreditation Council, Center for Disease Control and Prevention, 2003

**SEA LEVEL RISE**

70. **Synthesis of Adaptation Options for Coastal Regions**  
This guide provides a brief introduction to key physical impacts of climate change on estuaries and a review of on-the-ground adaptation options available to coastal managers to reduce their systems’ vulnerability to climate change impacts. Estuaries are highly and uniquely vulnerable to climate change.

Download ▶ http://water.epa.gov/type/oceb/cre/upload/CRE_Synthesis_1-09

71. **Resilient Coasts: A blueprint for action**  
This blueprint was designed for federal, state and local leaders and identifies critical steps to reduce risks and losses due to climate change. It discusses basic principles of coastal resiliency, and suggests strategies for climate change adaptation, including financing and insurance. The blueprint is designed to help individuals, communities and ecosystems withstand and recover from the impacts of coastal storms and rising sea levels.

Heinz Center and Ceres, Apr 2009, 9pp.

72. **Coastal Communities and Climate Change: Maintaining future insurability**  
This report looks at the impact of climate change on flood risk at a number of coastal locations around the world, considering sea level rise, the effect of wind speed on storm surges, and changes in land use. Although the four case studies mentioned in the report are from outside the United States, the lessons learned are applicable to any coastal community. That the publisher is a large insurance company may aid planners in making the case for adaptation action.

Download ▶ http://www.lloyds.com/~/media/Lloyds/Reports/360/360%20Climate%20reports/360_360_Coastalcommunitiesandclimatechange.pdf

73. **Adapting to Coastal Climate Change: A guidebook for development planners**  
This guidebook provides a 5-step process for integrating climate change adaptation into development planning in coastal regions. The guide goes in-depth into assessment, action selection, integration,
implementation, and evaluation. It also provides descriptions of several coastal adaptation measures.


74. The Resilience of New Orleans: Urban and coastal adaptation to disasters and climate change
This report includes an assessment of the carrying capacity of Coastal Louisiana in terms of geography, infrastructure costs, and land use challenges and opportunities. The methodology used can guide similar assessments for other coastal regions.

Download › http://www.lincolninst.edu/pubs/1508_The-Resilience-of-New-Orleans

75. Guidance for Municipal Stormwater Funding
This paper discusses the evolution of local government’s role in municipal stormwater management and serves as a resource to local practitioners as they address stormwater program financing challenges. The guide covers various sources of funding, legal considerations, implementation of stormwater funding programs and case studies from U.S. cities.


76. How to Become StormReady®
This website provides guidelines and a toolkit to emergency managers to help them prepare their communities for severe storms, and explains how to apply to become a StormReady community. As of August 2010, there were 1,637 StormReady sites, including cities, counties, and commercial properties.

National Weather Service, last updated Feb 2010
Website › http://www.stormready.noaa.gov/howto.htm

77. Stemming the Tide: How local governments can manage rising flood risks
This study analyzes how Virginian local governments can use existing land use powers to adapt to climate change impacts such as, flooding and coastal erosion, increased pressures on emergency response and rising infrastructure and property damages. The study also looks at legal obstacles and specific land use tools for local governments implementing policy identified in Virginia’s Climate Action Plan.

Download › http://www.georgetownclimate.org/sites/default/files/Va-Case-Study(1).pdf

78. Urban Flooding
This document gives an overview of UK approaches to managing urban flooding, including dealing with an overwhelmed sewer system, and examines ways to improve policy.


This text provides guidance on managing the risk of floods in an urban environment and serves as a primer for decision and policy makers across sectors.
WATER SUPPLY

80. **EPA Climate Ready Estuaries Coastal Toolkit**

This webpage compiles resources for estuaries and coastal programs that are interested in learning more about climate change impacts and adaptation. Estuaries are highly and uniquely vulnerable to climate change.

Download ➤ [http://www.epa.gov/CRE/toolkit.html](http://www.epa.gov/CRE/toolkit.html)


The 2006 WGA Water Report contained broad-ranging recommendations in six areas to address the ever-increasing water resources challenges facing states in the West. The 2008 Next Steps Report presented the results of activities to implement the 2006 Report and identified 42 specific recommendations, plus an additional three priorities. The 2010 Progress Report also highlights various implementation efforts, and summarizes the proceedings of different workshops and symposia, but does not include further recommendations.

**Western Governor’s Association and Western States Water Council**, June 2010, 32pp.

82. **Become a Water Sense Promotional Partner**

This website explains the benefits of entities, such as local government utilities, of becoming Water Sense promotional partners, including access to promotional material templates, and case studies of best practices.

**EPA**, last updated Jul 2010
Webpage ➤ [http://www.epa.gov/watersense/partners/become_a_watersense_partner.html](http://www.epa.gov/watersense/partners/become_a_watersense_partner.html)

83. **Clean Water Financing: Water Quality Cooperative Agreements**

This page links to a number of water impact-relevant funding programs, including the Clean Water State Revolving Loan Fund (e.g. for estuary protection projects), Water Quality Cooperative Agreements, and Drinking Water State Revolving Loan Funds.

**EPA**, last updated Jul 2010
Webpage ➤ [http://water.epa.gov/grants_funding/cwf/waterquality.cfm](http://water.epa.gov/grants_funding/cwf/waterquality.cfm)

84. **Emerging Climate Change Impacts on Freshwater Resources: A perspective of transformed watersheds**

This report discusses the effect of climate change on freshwater resources in the United States. Six case studies illustrate regional, cost-effective adaptation efforts for climate change affecting freshwater sources: Colorado River, Boston Metro, New York City, Flint River, Everglades, and San Joaquin River. Starting on page 24 the report also lists adaptive responses to climatic effects.

85. **California Water Success Stories, Executive Summary**
   
   This executive summary sketches 29 stories of effective water management in a variety of contexts. Though an older resource, it helps make the case that sustainable use of water does not require extraordinary actions, but rather a commitment to expanding existing, positive trends. It also reviews the repeating themes and success factors across the cases.


86. **Solutions: Saving water for the future**
   
   This report includes an outline of Denver’s water utility programs and projects to conserve and recycle water, including incentive, education, and outreach programs for the public.


87. **U.S. Drought Portal (NIDIS)**
   
   The U.S. Drought Portal is part of the interactive system designed to: provide early warning about emerging and anticipated droughts; assimilate and control the quality of data about droughts and models; provide information about risk and impact of droughts to different agencies and stakeholders; provide information about past droughts for comparison and to understand current conditions; explain how to plan for and manage the impacts of droughts; and provide a forum for different stakeholders to discuss drought-related issues. Drought information can be viewed by state or region.

   *National Integrated Drought Information System*, 2006
   Website ➤ [http://www.drought.gov/portal/server.pt/community/what_is_nidis/206](http://www.drought.gov/portal/server.pt/community/what_is_nidis/206)

### WILDFIRE

88. **Firewise Communities**
   
   This website houses information for individuals, firefighters, developers and municipal officials on reducing wildfire risk in communities, particularly in the rural-urban interface.

   *National Fire Protection Association*, 2012

89. **California Fire Alliance**
   
   This website houses a wide range of information including sample community fire plans.

   *CFA*, 2012
   Website ➤ [http://www.cafirealliance.org/](http://www.cafirealliance.org/)

90. **Preparing a Community Wildfire Protection Plan**
   
   This report from the National Association of Counties, National Association of State Foresters, the Society of American Foresters and the Western Governor’s Association provides a step by step process to develop a community level plan.

Getting a Commitment to Adaptation

This list includes resources for communicating effectively about climate change adaptation. Included are examples of climate change adaptation communication, communication aides, persuasion strategies, and community engagement guides.

EXAMPLES OF EFFECTIVE COMMUNICATION

91. Engaging Chicago’s Diverse Communities in the Chicago Climate Action Plan
   This website provides links to the Field Museum’s Division of Environment, Culture and Conservation’s (ECCo) reports on community engagement in Chicago regarding implementation of the Chicago Climate Action Plan. The reports describe an inclusive approach for soliciting public perceptions of climate change issues.
   The Field Museum Division of Environment, Culture, and Conservation, City of Chicago Department of Environment, Aug 2010
   Website ▶ http://fieldmuseum.org/explore/department/ecco/engaging-chicago-communities-climate-action

92. Preparing for Climate Change in the Great Lakes Region
   This report summarizes the observations and findings from a one-day workshop of forty representatives from Great Lakes foundations, non-governmental organizations, agencies, and universities. The workshop’s objectives were to identify policy changes that will enable Great Lakes communities to adapt to climate change and protect major ecosystems, and to identify strategies for implementing those policy changes.
   Michigan Sea Grant, Feb 2009, 32pp.

   A brief, practical guide that officials can use as a model to engage their own business sectors. This guide for the private sector gives an overview of what risk and opportunities climate change may pose for Scottish businesses and explains how to build the adaptive capacity to deal with these risks.
   Scottish Climate Change Impacts Partnership, 12pp.

94. UKCIP’s Climate Adaptation Resource for Advisors (CLARA)
   This tool is useful for U.S. practitioners who want to engage their local business community. CLARA is a web-based UK resource aimed at helping business advisors support small and medium enterprises (SMEs) in understanding and preparing for the impacts of climate change. The factsheets are designed to be accessed directly by the business community. The site provides background information on climate change, and advice on how to make the business case.
   UK Climate Impacts Programme, 2010
   Website ▶ http://www.ukcip.org.uk/clara/

95. Business as Usual
   Developed for London, this paper could be used by officials elsewhere looking to engage and evolve their area’s financial industries. It poses questions for discussions held between the Mayor of London and the city’s financial leaders in insurance, pensions, fund management, banking, infrastructure, and utilities.
regarding the need for them to take account of climate impacts.

Download ▶ http://www.london.gov.uk/lccp/publications/business-usual.jsp

### MAKING THE CASE

96. **Low Carbon Scotland: Public Engagement Strategy**
   This publication, part of the Scottish Government’s Climate Change Adaptation Toolkit, provides a step-by-step guide for writing an effective communications strategy.
   
   The Scottish Government

97. **NOAA Weather Service**
   This website provides access to severe weather watches, information, and outreach tools which can be tailored for local public warning systems. Topics include air quality, excessive heat, fire weather, flooding, severe storms, and winter weather.
   
   NOAA
   Website ▶ http://www.noaa.gov

98. **Learned Lessons on Key Considerations for Communicating Climate Risk**
   This webpage summarizes key considerations for communicating climate risk, based on lessons learned from developing climate risk communication strategies and implementing them on the ground in Africa and Asia, but applicable elsewhere. (Based on a synthesis report of the Advancing Capacity to Support Climate Change Adaptation project, which can be downloaded at http://start.org/download/acca-synthesis.pdf.) Strategies described are: two-way dialogue; knowing the local context; understanding the local know-how on climate risk; engagement in the process; combining strategies to target different stakeholders; strategic use of space; and innovative ways of communicating.
   
   weADAPT, last modified Aug 2010

99. **Climate Communications and Behavior Change**
   This guide illustrates the challenges with existing climate change communications efforts and provides tips on how to frame and deliver outreach efforts in a way that motivates changes in thinking and behavior for a range of audience segments. The focus is not on climate adaptation, though the guide does include some tips explicit to it.
   
   Cara Pike, Bob Doppelt, Meredith Herr, Climate Leadership Initiative, University of Oregon, 2010. 54pp.
   Download ▶ http://www.theresourceinnovationgroup.org/storage/PubHealthPrepManual5-10LR.pdf

100. **Hold That Thought! Questioning five common assumptions about communicating with the public**
   This report discusses false assumptions about communicating with the public, and provides some guidance about designing more effective communications. The false assumptions are: We need to get the word out; We already know how to communicate; If they only had information Z then, recipients of our information will consider it thoughtfully; and, Successful communication is an art.
   
   Joe Cone, Oregon Sea Grant: Public Science Communication Research & Practice, 16pp.
101. **Expand Your View: Insights for public communicators from behavioral research**

   This primer provides a research-based look at how to improve communication effectiveness. Topics include understanding and addressing psychological barriers, embracing voluntary learning, and fomenting social change. Not specific to climate change but useful to such public officials.


   Download [http://seagrant.oregonstate.edu/sgpubs/onlinepubs/h08005.pdf](http://seagrant.oregonstate.edu/sgpubs/onlinepubs/h08005.pdf)

102. **Telling the Tale of Disaster Resistance: A guide to capturing and communicating the story**

   This guidebook provides some of the “best practices” of those who have promoted disaster-resistance efforts throughout the country, which can serve as one component in an overall adaptation outreach strategy. This publication explains what value documenting and disseminating disaster resistance provides to local governments, and provides a step-by-step guide on how to document disaster-resistance efforts, offers guidance for developing story leads, researching and documenting projects, and creating and promoting a finished product.


   Download [http://www.fema.gov/library/viewRecord.do?id=1762](http://www.fema.gov/library/viewRecord.do?id=1762)

103. **Communicating Climate Change: Podcasts with Social Scientists**

   This website features extended audio interviews with leading social scientists about the human dimensions of climate change. The podcast is aimed at professional science communicators, whose job it is to explain complex scientific concepts and the work of scientists to the public at large.

   Produced by Joe Cone, *Sea Grant Oregon*, last updated Aug 2010

   Website [http://blogs.oregonstate.edu/communicatingclimatechange](http://blogs.oregonstate.edu/communicatingclimatechange)

104. **Setting the Record Straight: Responses to common challenges to climate science**

   This brief document provides credible responses to some common ‘skeptic’ arguments against climate change. For more detailed, in-depth, treatment, see Grist’s guide, "How to Talk to a Climate Skeptic" [http://www.grist.org/article/series/skeptics](http://www.grist.org/article/series/skeptics).

   CLI, Jan 2009, 9pp.

   Download [http://www.theresourceinnovationgroup.org/storage/Setting_record_Straight.pdf](http://www.theresourceinnovationgroup.org/storage/Setting_record_Straight.pdf)

105. **Climate Solutions for a Stronger America: A Guide for Engaging and Winning on Climate Change & Clean Energy**

   This guide provides communication strategies for candidates, business and civic leaders and others advocating for climate and clean energy solutions in the public sphere.


   Download [http://www.climateaccess.org/sites/default/files/Breakthrough_Climatel_Solutions%20for%20a%20stronger%20America.pdf](http://www.climateaccess.org/sites/default/files/Breakthrough_Climatel_Solutions%20for%20a%20stronger%20America.pdf)

**COMMUNITY ENGAGEMENT**

106. **Introduction to Stakeholder Participation**

   For those brand new to stakeholder participation, this document briefly examines several important aspects of stakeholder participation, provides guidance on identifying coastal management stakeholders, describes some of the most commonly used techniques, and discusses evaluation of stakeholder
participation.
NOAA, 20pp.

107. Stakeholder Engagement Strategies for Participatory Mapping
The participatory mapping tool is designed to help engage the public in land use decisions. The maps represent society’s values, including social, cultural and economic values. The publication provides facilitators with strategies to lead a participatory mapping process. This process is particularly useful in creating opportunities for stakeholder participation, capturing new information, and building community understanding and knowledge of climate risks. The mapping exercise also helps decision makers build community resilience and make better coastal management decisions.
NOAA, 28pp.

108. Participatory Learning and Action: Community-based adaptation to climate change
Through reflections, case studies and descriptions of available participatory tools, the authors give an overview of working in communities on adaptation efforts. The first section includes reflections on participatory processes and practice in community-based adaptation to climate change. These have a variety of entry points, including participatory vulnerability analysis and disaster risk reduction frameworks. The second section focuses on participatory tool-based case studies and describes a participatory process with an emphasis on the use of a particular tool. The third section, participatory tools, includes shorter, step-by-step descriptions of how to facilitate a particular tool in a community.
Download ➤ http://pubs.iied.org/pdfs/14573IIED.pdf