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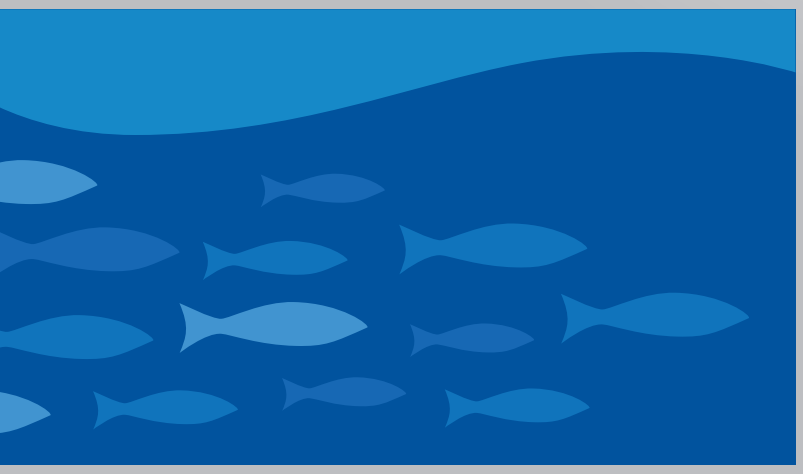
Getting Climate SMART

A Water Preparedness Guide for State Action



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A Water Preparedness Guide for State Action

Getting Climate SMART

In recent years, a record number of extreme weather events including floods, heat waves, droughts, fires and snowstorms have wreaked havoc in the United States. As carbon pollution continues to warm the planet and fuel extreme weather, it is critical that states begin planning for a new "normal."

This guide provides information for state governments, water managers and other stakeholders to use in preparing for the consequences of hotter temperatures, more variable and volatile precipitation events, and rising seas. By undertaking climate preparedness planning, states can better manage the impacts of climate change and protect the well-being of residents, communities, the economy and natural resources.

Fourteen different extreme weather events, including widespread drought and massive flooding, each caused damage of more than $1 billion in 2011.[1] In 2012, scorching heat brought drought conditions to more than 65 percent of the country and contributed to large wildfire outbreaks in the West that burned more than 9.2 million acres.[2,3] Severe storms and tornadoes also ravaged large swaths of the country. Additionally, in late October 2012, Superstorm Sandy devastated communities along the northeastern seaboard with record-breaking storm surges and historic flooding. In total, 11 extreme weather events in 2012 had costs exceeding $1 billion each.[4] Moreover, 2012 was the hottest year since record-keeping began in the U.S. in 1895.[5] As climate change increasingly fuels extreme weather, this trend of more extreme and record-breaking climate events shows no signs of abating.

Many extreme weather events as well as warmer temperatures, changing precipitation patterns and rising sea levels are expected to intensify as climate change continues. These deviations from historical climatic norms are affecting our communities and natural resources by threatening public health, affecting water availability and quality and energy production, placing vulnerable homes and infrastructure at risk, and jeopardizing vital ecosystems and habitats.

Table 1. Climate change impacts on water resources and water-related uses.[6]

Changes in Climate and Related Factors	Impacts on Water Resources and Uses
Warmer air temperatures	Increases in water demand for irrigation and power plant cooling; decreases in lake and reservoir levels and streamflow; warmer water temperatures
Warmer water temperatures	Reductions in dissolved oxygen; potential increases in harmful algal blooms; less thermally suitable habitat for aquatic species
Changes in precipitation, streamflow and groundwater recharge	Implications for water availability
Earlier snowmelt and more precipitation falling as rain instead of snow	Increases in wintertime flooding risks and changes to water availability; shifts in streamflow timing
More intense rainfall events	Increases in flooding risks; increases in stormwater runoff, which can overwhelm sewer infrastructure and lead to discharges of untreated sewage
Shifts in streamflow timing	Implications for water availability and hydropower production; impacts on aquatic species
Drought conditions	Threats to all water users (e.g., municipalities, agriculture, industry, aquatic species)
Rising sea levels	Increases in coastal flooding and erosion; saltwater intrusion into coastal aquifers and estuaries
Increasing atmospheric concentrations of carbon dioxide	Decreases in ocean pH, which affect marine organisms, habitats and food webs

To address these challenges, more than 35 states have conducted planning to reduce the carbon pollution that contributes to climate change. Despite these efforts, however, states already are experiencing the impacts of climate change and will need to plan and prepare for the wide-ranging consequences of increasingly warmer temperatures, variable precipitation patterns and higher seas. To date, only 10 states have developed comprehensive plans to prepare for these climate-related impacts.[7] Remarkably, most other states are not planning and remain ill-prepared for the challenges of climate change both now and in the years ahead.

States can use the six-step process in this guide to comprehensively plan and prepare for the water-related impacts of climate change. Although this guide focuses exclusively on climate impacts related to water, non-water impacts also will have wide-ranging ramifications for people, communities and ecosystems and must also be considered in climate preparedness planning.

Climate impacts will vary by region, and the strategies and resources available to manage these impacts will be shaped and limited by existing state laws, policies and resources. Accordingly, the process for developing a state climate preparedness plan contained in this guide is divided into three different tracks: Basic, Moderate and Robust. States can follow a single track throughout the planning process or choose to follow different tracks for each step. Additionally, specific examples are included to illustrate how some states have conducted their planning process. The most important message is that all states must start the planning process now. The signs of a changing climate are already being seen, and continued delay and inaction will only magnify the impacts and the cost of addressing them.

PLANNING TRACKS AND STEPS

Basic: Every state can take meaningful steps to address the water-related threats from climate change. Components of this track are not likely to require additional funding, additional staff resources, or legislative or regulatory changes. Preparedness strategies focus on no-regret and low-regret approaches, which provide multiple benefits with relatively minor investments.

Moderate: States on this track have the capacity to mobilize more resources to develop a climate preparedness plan. They can conduct a more in-depth assessment of potential climate change impacts and related vulnerabilities and can consider more resource-intensive preparedness strategies. This track may require additional funding for the planning and implementation processes.

Robust: Climate change is a top-level priority for states choosing this track, and there is substantial support and capacity for climate preparedness planning. The planning process likely requires additional funding and technical resources and greater stakeholder engagement. Preparedness strategies considered for implementation include the creation of new institutions, system-wide retrofits and changes to regulatory and legal frameworks.

Figure 1. The six minimum steps for developing and implementing a state climate preparedness plan.

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STEP 1
Build Support and Commit to Climate Preparedness

How does a state start the planning process?

A formal commitment to the planning process is necessary for a strong plan and is integral for sustaining state action on climate change. This commitment can take many forms, including legislative and/or executive-level action. However, education and outreach on potential climate impacts are often first necessary to build support for preparedness planning. Reaching out and informing state agency officials, legislators and the governor's office about local, regional and statewide impacts can help to build concern, interest and support for formal climate preparedness planning. Educating the public about climate impacts and the need for planning also can be useful for persuading and urging government officials and legislators to act.

STEP 2
Establish Coordinating Groups and Goals

Who should help develop a plan?

Having diverse teams and work groups ensures that a wide variety of interests within the state are considered during the planning process. In particular, representatives from local, county and state governments; community and nonprofit organizations; research institutions; the private sector; and the public all will play a role in building community and statewide resilience to climate change. Bringing all of these groups to the table helps to forge new relationships that will be critical when implementing the plan. Additionally, establishing overarching goals and guiding principles helps the planning process by ensuring that all work groups have similar expectations and objectives.

STEP 3
Assess Climate Impacts, Risks and Vulnerabilities

What are the likely future changes in temperature, precipitation and sea levels, and how will these changes impact various sectors across the state?

Information on potential climate risks is available from research institutions and federal government agencies or directly from scientists. It is important to consider the different climate impacts and vulnerabilities across various regions in the state so that the most at-risk sectors and systems can be identified and prioritized for preparedness strategies. How far into the future to evaluate changes in climate is another important consideration.

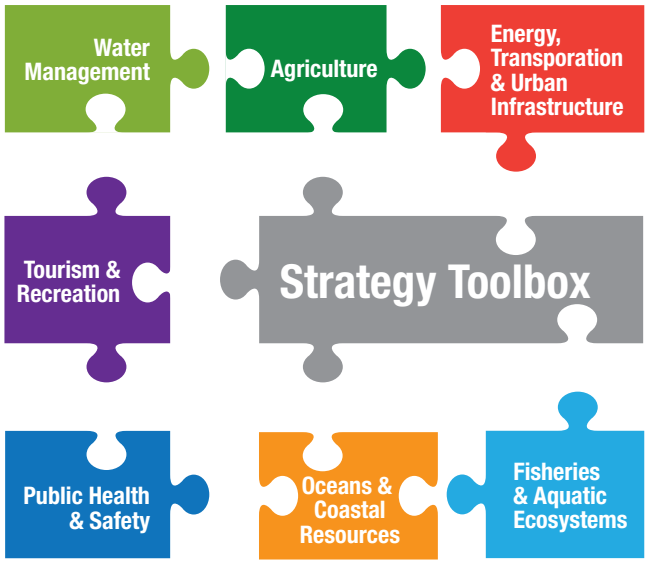

Figure 2. The seven sectors included in the Strategy Toolbox.

STEP 4
Determine Preparedness Strategies

What strategies should be included in a plan?

This guide contains a toolbox of more than 600 strategies for dealing with climate risks as they relate to seven sectors: agriculture; energy, transportation and urban infrastructure; fisheries and aquatic ecosystems; oceans and coastal resources; public health and safety; tourism and recreation; and water management.

These strategies have been identified from an extensive literature review and have been evaluated by subject matter experts to ensure they will help to build the resilience and reduce the vulnerability of people and ecosystems to climate change impacts. Many of these strategies are familiar best management practices because effective management of existing threats to water resources builds long-term climate resilience.

Within the toolbox, strategies are organized by sector and then by what goal or outcome the strategy achieves. Individual strategies are generally listed from less intensive to more intensive in terms of resources needed and the length of time that will likely be necessary to implement the strategy. Less intensive strategies are generally lower-cost and achievable in the short term—though these strategies often also provide long-term benefits. More intensive strategies may require the creation of new institutions, system-wide retrofits or comprehensive regulatory changes, and these strategies likely will be the most effective at building resilience and reducing long-term vulnerability to climate impacts. Given the vast differences among states in terms of existing resources, regulations, and technical and financial capacity, planning groups will need to consider whether each strategy listed is relevant and feasible in their state.

Figure 3. The process for using the Strategy Toolbox to determine strategies to include in the climate preparedness plan.

Planning groups can use the Strategy Toolbox to determine which actions are the most appropriate for the state and local contexts by following the process shown in Figure 3.

When determining the type of strategies to recommend, the planning groups should take into account cost-effectiveness, resources necessary for implementation (including up-front costs and public support) and whether the strategy potentially yields multiple benefits, among other factors. Possible barriers to implementation also should be considered, and strategies that are most likely to be successful given existing regulations and institutions should be prioritized. As part of this process, groups will need to consider actions that can be accomplished by state agencies and what opportunities and incentives are needed to facilitate action by regional and local agencies, the private sector and other nongovernmental entities.

Table 2. Examples of preparedness strategies from each of the seven sectors.

Sector	Goal	Example Strategy
Agriculture	Expand and Diversify Agricultural Water Supply	Reduce water loss in existing irrigation systems through maintenance and repair
	Reduce Water Demand	Use crop idling/fallowing where appropriate
	Manage Water Quality Impacts	Use buffer strips of riparian vegetation/vegetated swales to slow bank erosion and filter drainage water from fields
	Build Crop Resilience to Climate Risks	Promote measures that capture rainfall by improving soil moisture retention and groundwater infiltration
Energy, Transportation and Urban Infrastructure	Manage Flood Risks	Change zoning ordinances to discourage development in flood-prone areas, thereby designing communities in ways that proactively mitigate risks
	Integrate Climate Change into Planning for Existing and New Infrastructure	Work with local jurisdictions to incorporate consideration of climate change into ongoing land-use planning efforts
	Manage Climate Risks to Transportation Infrastructure	Accelerate use of green infrastructure in local capital improvement plans
	Manage Climate Risks to Communications and Energy Infrastructure	Revise building codes to allow positioning of emergency generators and fuel supplies at higher levels

Table 2. Examples of preparedness strategies from each of the seven sectors (continued)**.**

Sector	Goal	Example Strategy
Fisheries and Aquatic Ecosystems	Protect and Restore Critical Habitat	Remove dams and other stream barriers where the adverse ecological harm outweighs any benefits provided by the structure or where the structure is dilapidated, outdated or no longer in use
	Improve Fisheries Management	Increase monitoring of stocks and maintain basic fish sampling
	Enhance Information and Outreach	Increase monitoring of species and habitats, particularly those that are vulnerable, against an established baseline over the long term
Oceans and Coastal Resources	Manage Coastal Climate Risks	Manage forests and wetlands to enhance ecological services and storm impact reduction
	Manage and Improve Understanding of Ocean Acidification	Reduce land-based sources of both point and non-point pollution that contribute to decreases in pH of coastal and ocean waters, particularly in estuaries with high freshwater inflow
Public Health and Safety	Enhance Existing Emergency Preparedness and Response Programs	Include in existing emergency response/preparedness/management plans events that will become more likely with climate change; consider the most updated estimates of likely levels of precipitation, flooding and extreme storm events
	Build Community Resilience	Incorporate climate change and public health messages into existing education and outreach efforts, targeting vulnerable populations, clinicians and health professionals
	Build Public Health Capacity	Facilitate and enhance regional coordination efforts among local boards of health
	Enhance Information and Research	Implement electronic surveillance systems to manage disease reporting and water quality concerns that pose a risk for human health
Tourism and Recreation	Manage Impacts on Recreational Areas	Reduce beach closings by using green infrastructure and other best management practices to reduce combined sewer overflows and polluted runoff into recreational waters
	Develop New Recreational Areas	Use riverfront lands with buffers for flood-tolerant recreation (e.g., walking paths, bike lanes, soccer fields, parks and natural areas) to help communities limit flood damage and reconnect residents to the river
	Enhance Outreach and Public Awareness	Educate recreational facilities about diversification opportunities for more warm-weather or cold-weather activities, with consideration of environmental impacts
Water Management	Address Water Supply Risks	Protect headwaters of rivers and streams through withdrawals/permit applications or other means
	Reduce Water Demand	Require water suppliers and local governments to develop and implement water conservation programs
	Prevent Water Quality Degradation	Ensure that existing drinking-water wells are adequately protected from potential contamination by conducting sanitary surveys and source-water assessments that consider climate change impacts
	Manage Impacts on Water, Wastewater and Stormwater Infrastructure	Reduce stormwater system inflow through green infrastructure and water conservation
	Enhance Statewide Water Resources Management and Planning	Monitor factors that impact hydrology and water resources
	Enhance Drought Preparedness	Update/develop state drought management plans to expressly include climate change considerations

Planning groups should consider and prioritize the inclusion of this guide's Top 10 No-Regret Strategies. These cost-effective and flexible strategies provide benefits now regardless of future climatic changes.

Top 10 No-Regret Strategies

- Reduce carbon pollution to minimize future climate impacts, thereby protecting public health and safety.
- Use green infrastructure to manage and collect stormwater and dry-weather runoff.
- Improve urban water conservation and efficiency.
- Improve water conservation and efficiency among commercial, industrial and institutional (CII) users.
- Increase agricultural water efficiency and manage water-quality impacts.
- Increase the use of reclaimed wastewater.
- Increase water efficiency in energy production to save water (and fish).
- Preserve and restore wildlife habitat for source-water and flood protection.
- Improve land-use planning to reduce building in vulnerable areas.
- Ensure effective emergency response and hazard mitigation planning.

STEP 5
Finalize the Plan

How does the final plan come together?

The climate change risks and preparedness strategies identified by the planning groups are compiled into a draft plan, which is then released for public comment. The public comment period presents an important opportunity for individuals and groups not directly involved with the planning process to provide input and feedback. Engaging the public also is integral to demonstrating transparency and inclusiveness and building support for implementation. Revisions are made to the draft based upon any meaningful comments received, and a final version is released.

STEP 6
Implement and Update the Plan

How does the plan get put into action?

A plan that is developed but that just sits on a shelf is of little use. Following the release of the final state climate preparedness plan, implementation begins. The identification of tasks, time frames and lead agencies responsible for implementation during plan development helps to facilitate this process. However, depending on a state's approach, the implementation process may start with translating planning strategies to on-the-ground actions. Outreach initiatives also may be necessary to educate agency personnel and the public about climate impacts and to build support for strategy implementation. This guide includes local and state implementation case studies and examples of state and federal funding programs that could be used to support implementation.

Once implementation begins, ongoing monitoring and periodic reevaluation help to gauge whether strategies are effective and preparedness goals are being achieved. The state also should regularly re-evaluate climate change projections as new research is completed. Because preparing for climate impacts is a continuous process, the state should commit to updating the climate preparedness plan on a regular basis to incorporate new developments.

CONCLUSION

To weather the variability inherent in the future, states need to plan and prepare for a wide range of impacts to ensure that communities remain resilient in the face of climate change. Whether states experience a significant lack of water or far too much, recent extreme weather disasters serve as a reminder of how dependent we are on our limited water resources and how vulnerable we are to deviations from the norm. Many more states need to develop and implement climate preparedness plans to protect individuals, communities and ecosystems. The mark that climate change is leaving on our nation's water resources is already being felt, and with climate impacts intensifying, it is critical that states start planning and preparing now. We cannot afford to wait any longer. There is far too much at stake.

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[1] "Extreme Weather 2011," National Oceanic and Atmospheric Administration (NOAA), revised January 19, 2012, www.noaa.gov/extreme2011/.

[2] "State of the Climate: Drought—Annual 2012," National Climatic Data Center (NCDC), NOAA, revised January 8, 2013, www.ncdc.noaa.gov/sotc/drought/2012/13.

[3] "State of the Climate: Wildfires—Annual 2012," NCDC, NOAA, revised January 7, 2013, www.ncdc.noaa.gov/sotc/fire/2012/13.

[4] "Billion-Dollar Weather/Climate Disasters," NOAA, accessed January 7, 2013, www.ncdc.noaa.gov/billions/events.

[5] "State of the Climate: National Overview—Annual 2012," NCDC, NOAA, www.ncdc.noaa.gov/sotc/national/2012/13#over.

[6] U.S. Global Change Research Program (USGCRP), "Water Resources," *Global Climate Change Impacts in the United States* (2009), 41-49, www.globalchange.gov/images/cir/pdf/water.pdf. USGCRP, "Regional Impact: Coasts," *Global Climate Change Impacts in the United States* (2009), 151, www.globalchange.gov/images/cir/pdf/coasts.pdf.

[7] Natural Resources Defense Council (NRDC), *Ready or Not: An Evaluation of State Climate and Water Preparedness Planning* (2012), 3, www.nrdc.org/water/readiness/files/Water-Readiness-full-report.pdf.

About American Rivers

American Rivers is the leading organization working to protect and restore the nation's rivers and streams. Rivers connect us to each other, nature, and future generations. Since 1973, American Rivers has fought to preserve these connections, helping protect and restore more than 150,000 miles of rivers through advocacy efforts, on-the-ground projects, and the annual release of America's Most Endangered Rivers®.

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About NRDC

The Natural Resources Defense Council (NRDC) is an international nonprofit environmental organization with more than 1.3 million members and online activists. Since 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and the environment. NRDC has offices in New York City, Washington, D.C., Los Angeles, San Francisco, Chicago, Montana, and Beijing.

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