# CHAPTER EIGHT IMPLEMENTING



Principles for Adaptation



### The Road to Implementation

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# ADAPTATION

limate change will result in both challenges and opportunities, in the present and across future generations. Individual citizens, businesses, government agencies and policy leaders will need to weigh these potential impacts when deciding which adaptation strategies to implement and when and how to implement them. The WICCI working groups have begun to identify a wide spectrum of possible adaptation strategies for confronting changes in our climate, and we summarize those changes and impacts in the first two parts of this report. The adaptation strategies reflect the work of Wisconsin's top scientists and resource managers using information available at the time of publication.

In this chapter, we present concepts to guide you in weighing decisions about adaptation strategy implementation as well as to help you choose the most appropriate strategies to achieve your end goals. We discuss several principles that pertain to climate change adaptation, and we mention specific adaptation strategies identified by the WICCI working groups to illustrate how adaptation strategies can be applied. Equipped with this information, you, the stakeholders, can take action. You can evaluate the climate change impacts on your region or sector of the state as well as the range of potential adaptation strategies to decide how you will respond.

# **Principles for Adaptation**

Here we provide several principles for you to consider when making decisions about climate change adaptation and determining which actions are feasible to take now, later or not at all. Our intention is for these concepts to provide you with perspective in decision-making and guidance for implementation of appropriate adaptive actions.

### Triage Approach

**Determine which actions to implement first.** The concept of triage involves directing resources to the issues and areas where strategic adaptation will be most effective. Adaptation can help us reduce risks and minimize impacts caused by climate change. We cannot, however, eliminate all risks and losses, even if

we implement the most appropriate strategies. In some cases, investments in adaptation are unlikely to have significant returns. In other cases, effects of climate change will pose little risk and thus require nothing new to be implemented. Stakeholders will need to consider the value of possible adaptation strategies based on the vulnerability of a particular resource and the likelihood that a specific action will successfully address an identified concern. This triage approach will allow you to target limited resources most efficiently.

### Adaptive Management

*Build flexibility into management practices.* Adaptive management offers a tool to help stakeholders





make better decisions in the context of uncertainty as we continue to accumulate more information. Often characterized as "learning as we go" or "learning by doing," adaptive management provides a structured, iterative, decision-making process that can be used in the face of uncertainty with an aim of reducing that uncertainty over time. This approach involves ongoing, real-time learning and knowledge creation, both in a substantive sense and in terms of the adaptive process itself. The approach allows you to maintain flexibility in your decisions, knowing that uncertainties exist, and provides the latitude to change direction. In this way, decision-making can simultaneously maximize one or more resource objectives and, either passively or actively, accrue information needed to improve future management. Using adaptive management approaches will allow us to take action to improve progress towards desired outcomes. Such approaches also allow for new climate information to be incorporated as we move forward.

### "No Regrets" Strategies

### Choose strategies that increase resilience and provide benefits across all future climate scenarios.

Implementation of some strategies will result in environmental or societal benefits no matter how the climate changes. We refer to these strategies as having no regrets. For example, protecting environmentally sensitive lands, encouraging water conservation and implementing polluted runoff controls makes sense under any climate scenario. These actions can build resilience without necessarily committing stakeholders and resources to novel future courses of action. We believe some of the best adaptation strategies will allow us to prepare for climate change by taking action now in ways that will not make adaptation in the future more difficult. The WICCI working groups identified actions that are intended to provide net environmental and social benefits under all future scenarios of climate change and impacts.

### Precautionary Principle

Where vulnerability is high, it is better to be safe than *sorry*. Sometimes if we wait for certainty it is too late. The 1992 Earth Summit in Rio de Janiero proposed, "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." Given the breadth of likely climate change impacts in Wisconsin and the associated risks to the public and environment, we believe a precautionary approach should be taken by stakeholders even if some causeand-effect relationships are not yet fully understood. Cases where the probability of risk is low but the vulnerability is very high suggest precautionary action should be taken. These "better safe than sorry" strategies can be modified later if new information suggests that no or minimal harm will result from a climate impact. The process of applying this precautionary principle must be open, informed and democratic and must include potentially affected parties. It must also involve an examination of the full range of alternatives, including taking no action.

# Adapting to Variability in a Changing Climate

*Expect variability and work within it.* Wisconsin's climate will continue to be highly variable across years and decades. Even though average temperatures have warmed and are projected to warm, and average



precipitation has increased and is projected to increase, there will still be unusually warm and cool years and unusually wet and dry years in the mix. It is essential to understand this variability in order to successfully implement adaptation strategies. For example, if brook trout disappear from a stream after a few unusually warm years, it may be possible to restock them to provide good fishing for a few cooler years before long-term warming trends cause them to die out again. If we had the ability to accurately project temperature variability between warm and cool over periods of a few years, our ability to manage threatened resources would be improved. The same logic is true for the operation of winter recreation facilities, crop-planting decisions and much of the annual planning done by individuals and groups. This highlights the need to improve our science: As we continue to monitor and better understand variability, we can continue to improve strategies for adapting.

### Place-Based Considerations

### Consider the restrictions and special circumstances of place-

based impacts. Adaptation to climate change is important because our human and natural systems are fixed in location. All of Wisconsin's human and natural systems are "placebased" (for example, individual farms, municipalities, lakes and natural areas) and we know that climate change impacts vary spatially. We will need to consider these spatial relationships when adopting adaptation strategies. For example, climate change will affect the distribution of culturally important resources such as wild rice and walleye, but some of the Native American tribes who rely on these resources may not be able to follow those shifts in ranges because their reserva-

tion boundaries and off-reservation treaty rights are geographically fixed. People may – at a cost – decide to move out of a floodplain as floods become more prevalent, but industries and agriculture and their institutions are tied to place and will have to deal with the changing climate and its impacts. Place-conscious planning and place-based strategies can leverage our investments by focusing resources in targeted places and compounding the effects of well-coordinated action. Such approaches can also streamline otherwise redundant and disconnected programs.

### Adaptation Complements Mitigation

### Recognize the place of adaptation in the bigger

*picture.* Adapting to climate change impacts is not a substitute for mitigation – the reduction of the rate at which greenhouse gases are emitted into the atmosphere. We can implement adaptation strategies that

help us adjust to and thrive in our natural and built environments as they are affected by climate change impacts at the same time as mitigation efforts are being enacted. The two goals can be pursued simultaneously, and in some cases, an adaptation strategy can achieve both adaptation and mitigation. For example, in Chapter 7: People and Their Environment, working groups suggest the need for programs and research on mass transit and vehicle technologies to both improve air quality and reduce ozone and greenhouse gases. We support and encourage the development and implementation of strategies that provide these cobenefits. As people better understand the impacts of climate change and how it affects air and water quality, our food systems and public health, they are likely to become more active in mitigation measures that address climate change at broader scales.

# The Road to Implementation

Now that we have reviewed the main principles of adaptation, we turn to some specific adaptation strategies that WICCI working groups have recommended in order to highlight *toward what end* these actions work. We present the discussion here, consistent with the framework laid out in Chapter 2: *Understand-ing Adaptation* and the Adaptation Strategies boxes throughout the chapters in Part 2: *Impacts*. These examples generally illustrate ways in which adaptation strategies can address the climate change impacts on multiple resources. Readers can refer to the full working group reports (available at www.wicci.wisc. edu) for adaptation strategies for specific resources or locations.

In order to reduce risks from climate change, adaptation will require decisions that acknowledge both space and time. To be effective, some strategies will need to be implemented on a broad scale (statewide), while other actions can be implemented at a particular place (local or site-based). Similarly, some adaptation strategies can be implemented in the short term, but others will require planning and preparation that extend well into the future.

### **Taking Action**

The "taking action" strategies include natural systems management choices, social systems improvements and infrastructure modifications. They allow us to manage risks effectively in the face of uncertainties. These actions generally fall into two categories. The first type relates to undertaking activities that could offset some of the negative impacts of climate change on specific resources. The second type relates to better directing management efforts and resources to locations where the actions will provide the greatest benefit. Some adaptation strategies involve doing both of these things. These types of strategies can occur at any level and do not require us to wait for federal or state governments to take action.

Implementing adaptation on a broad scale. Protecting environmentally sensitive agricultural lands by enrolling them in the Conservation Reserve Program (CRP) or similar federal or state programs could help offset some negative climate change impacts. By targeting such conservation efforts to specific areas, we can provide even greater benefits. The Coldwater Fish and Fisheries Working Group identified setting aside land in this manner as a potential adaptation strategy for coldwater streams. Maintaining native vegetation on such lands would help maintain water temperatures and prevent soil losses. The working group recommended a "triage" strategy of allocating limited resources to streams where this type of effort can delay the loss of trout. This "no regrets" strategy could help in reversing the loss of wetlands and restoring prior converted wetlands to provide storage and filtration capacity as recommended by the Water Resources and Green Bay Working Groups. This "precautionary" approach also would reduce erosion from intense rainfall events as suggested by the Soil Conservation and Stormwater Working Groups. Finally, this approach could help establish and maintain corridors of contiguous natural vegetation, an adaptation strategy identified by the Plants and Natural Communities and Green Bay Working Groups.

### Adapting at the local level: building urban green

*infrastructure.* Increasing green space in our urban communities is an adaptation strategy identified by a number of WICCI working groups. Integrating green infrastructure (open space, green roofs, tree canopy, etc.) into planning and development can reduce both stormwater runoff and heat island effects. These

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actions help build resilience. As noted by the Milwaukee and Stormwater Working Groups, green infrastructure can also help reduce combined sanitary sewer overflows and prevent flooding.

To maximize the multiple potential benefits of green infrastructure, a regional perspective could facilitate cooperation among local jurisdictions. For example, Wisconsin's regional planning commissions have regional planning mandates and relatively long planning horizons:

"The Southeast Regional Planning Commission (SEWRPC) was created in 1960 to provide the basic information and planning services necessary to solve problems which transcend the corporate boundaries and fiscal capabilities of the local units of government comprising the Southeastern Wisconsin Region. creating a better understanding of climate science, impacts and adaptation strategies along with tools for resource managers and other decision-makers. These "building capacity" strategies include conducting applied scientific research, developing local modeling and management frameworks, implementing new management techniques at the local and program level and training and educating natural resource managers and others to use new tools.

*Supporting Wisconsin's State Climatologist.* The Wisconsin State Climatology Office, affiliated with the UW-Madison's Department of Atmospheric and Oceanic Sciences, manages data for climate monitoring, provides climate information to Wisconsin residents and government agencies, develops "value-added" products for users and impact applications and conducts applied climate research. We recognize the



### Building Capacity

The WICCI working groups identified a number of adaptation strategies that involve

Photo: Callen Hart









importance of additional state funding and continued support the State Climatology Office.

### A framework for local government planning. Work-

ing with the Wisconsin Towns Association, League of Wisconsin Municipalities, regional planning commissions and other local government associations, the WICCI working groups can expand efforts to help communities integrate climate adaptation strategies into local community planning activities. Communities can have greater confidence in their emergency management and hazard mitigation plans if they consider climate change impacts and the associated vulnerabilities. Similarly, land use and development plans that factor climate change scenarios into their future projections will better serve communities in guiding future development patterns. Along these lines, the Coastal Communities. Water Resources and Green Bay Working Groups suggested that communities may want to re-examine ordinances and wetland and shoreland management programs to be sure that they make sense given a likely increase in bluff recession rate, fluctuations in water levels and increasing frequency of extreme events. Communities should create or update comprehensive plans and periodically revisit and revise these plans and implement ordinances, as needed. This "precautionary" approach also could help reduce erosion

from intense rainfall events as suggested by the Soil Conservation and Stormwater Working Groups.

Short-term solutions: new species management

*techniques.* There will always be variability in climate and climate change impacts. We can best manage variability by understanding the tradeoffs it presents. For example, fisheries managers will need to respond to changes in stream water temperatures. In warmer years, managers may want to substitute brown trout for brook trout in their stocking programs because brown trout are slightly more tolerant of warmer water. Alternatively, these managers could use a "put-and-take" approach for cold months that provides short-term angling opportunities while acknowledging that the brook trout will die off in a near-future summer.

### Communicating

The WICCI working groups identified a number of adaptation strategies related to articulating the risk from future climate and the need for polices and planning that will maintain society's flexibility for adapting to new and future impacts. These "communicating" adaptation strategies include dialog with the public, decision-makers, community groups, local governments, nonprofits and others about impacts from climate change and the benefits of adaptation.

#### Short-term adaptations: informing the public of

*risks.* Implementation of some strategies will result in benefits regardless of how climate changes. For example, public protection authorities (county sheriffs, conservation wardens, etc.) and weather news personnel may want to consider providing short-term risk advice on issues including thin-ice hazards on lakes or heat-related health risks.

#### Broad-scale adaptation: informing public officials.

Working with UW-Extension, Sea Grant and other educational organizations, the WICCI working groups can expand efforts to provide local governments with information about climate science, projected impacts, types of adaptation strategies and means of implementing those strategies. Enhanced communication will be particularly important in cases where the probability

## WHAT IS A COMPREHENSIVE PLAN?

A comprehensive plan is a local government's guide to community physical, social and economic development. Comprehensive plans are not meant to serve as land use regulations in themselves; instead, they provide a rational basis for local land use decisions with a 20-year vision for future planning and community decisions.

The Wisconsin Comprehensive Planning Law does not mandate how a local community should grow, but it requires public participation at the local level in developing a vision for the community's future. The uniqueness of individual comprehensive plans reflects community-specific and locally driven planning processes.

While a local government may choose to include additional elements, a comprehensive plan must include at least all of the nine elements below, as defined by the Comprehensive Planning Law.

- Issues and Opportunities
- Housing\*
- Transportation\*
- Utilities and Community Facilities\*
- Agricultural, Natural and Cultural Resources\*
- Economic Development\*
- Intergovernmental Cooperation
- Land Use\*
- Implementation

\* elements affected by climate

Element Guides are available online at www.doa.state.wi.us.

of risk is low but the vulnerability is very high and "better safe than sorry" measures could significantly offset possible impacts. This could include efforts to educate communities about the hazards of building in areas prone to high water or coastal erosion, as recommended by the Coastal Communities, Water Resources and Stormwater Working Groups, or about ways to minimize sanitary sewer overflows, as noted by the Coastal Communities, Stormwater and Milwaukee Working Groups.

### Filling Gaps

The WICCI working groups identified a number of adaptation strategies that involve expanding our knowledge about how natural and human systems will respond to climate change. "Filling gaps" includes basic scientific research, establishing data-gathering programs, improving climate modeling and learning from climate adaptation efforts in other states. While much of this work will fall to the University and state agencies, there is room for many other players to be involved in defining information needs and helping ensure that research and monitoring improve our ability to assess risk and proactively adapt.

*WICCI's next report.* In this report the working groups assessed vulnerabilities and suggested adaptation strategies using currently available information and resources. An important part of filling the gaps will be recruiting additional participants for WICCI working groups to respond to emerging knowledge that results from ongoing research and new scientific discoveries. Additional working groups will be needed to address new focus areas. We expect to produce our next report in about four years.

#### Preparing for adaptive management: broad-scale

monitoring. In order to recognize the reality of variability in climate and adapt accordingly, we will need to understand how variability manifests itself in future climate scenarios and how it is reflected in natural processes and human systems. Adaptive approaches that allow new information to be incorporated as we move forward will increase our flexibility in how we respond to changes. Along these lines, several working groups recommended instituting better, more robust climate monitoring programs. For example, the Wisconsin Department of Natural Resources and University of Wisconsin can work with federal, state and local partners (for example, the National Oceanic and Atmospheric Administration, U.S. Geological Survey, local public works and public health departments) to support a network of monitoring stations for collecting important observations. These include systems to measure rainfall, stream flows and water levels as well as surveillance programs for harmful algal blooms and beach pathogen outbreaks. As noted by the Forestry

and Agriculture Working Groups, climate science that increases the certainty around precipitation trends and patterns will assist us in better impact modeling. Similarly, the Stormwater Working Group found that improving and maintaining Wisconsin's climate monitoring network would provide continued high-quality data to support short- and long-term impact modeling. The Human Health Working Group noted the importance of the Wisconsin Pubic Health Tracking Program for tracking indicators of air pollution that may be affected by climate change.

**Preparing for adaptive management: species- and community-specific assessments.** Resources remain insufficient to address all possible threats. To help reduce the uncertainty in making decisions about resource allocations, both the Plants and Natural Communities and Wildlife Working Groups recommended that risk assessments be made based on impact predictions for individual species and natural communities. Similarly, the Green Bay Working Group identified a number of species and community-specific information needs. These assessments could be used in prioritizing adaptation actions. As climate scientists improve global climate models and refine downscaling results, we will have more and better data on which to base such assessments.

> A more complete discussion of climate adaptation can be found in the WICCI Adaptation Working Group report, available online at www.wicci.wisc.edu.

### Conclusion

Climate change is a complex phenomenon with impacts on every sector of our lives. As you, the stakeholder, assess the information presented in this report and consider your options for taking action, the principles outlined in this chapter can guide your decision-making and implementation. These principles can help you consider which actions to implement first, the degree to which flexibility can be built into resource management practices and whether some strategies will bring benefits regardless of how the climate continues to change. They suggest that when vulnerability is high, it may be a better strategy to be safe rather than sorry; they remind that variability is a reality to be recognized and that some place-based impacts present unique restrictions and circumstances for adaptation. Lastly, these principles include a call for a big-picture view of adaptation, recognizing that adaptation strategies can and should be implemented alongside mitigation efforts.

This report presents a wide range of strategies for you to consider as you chart your adaptation course. You may implement these strategies to work towards a variety of goals, including taking action to confront climate impacts; building capacity for understanding climate science, impacts and adaptation; communicating the challenges and opportunities brought on by climate change; and filling the gaps in our scientific and management knowledge. This report is the first step on a long road of strategic climate adaptation in Wisconsin. The next step is yours.

