

CHAPTER TWO

UNDERSTAN



**Frameworks
for
Understanding**



**WICCI and
Adaptation**



DING ADAPTATION

Climate adaptation is nothing new – rather, it is an ongoing process in human society and in the natural world. Adaptation is a matter of adjusting to our natural and built environments as they change, with the goal of thriving in our habitats and communities. For example, people migrate to areas with suitable climate or plant specific crops for which the growing conditions are well-suited. Plants and animals adapt to changes in their habitat conditions, as well. Sometimes adaptation is driven by threats, and other times opportunity drives adaptation.

Adaptation is a matter of adjusting to our natural and built environments as they change, with the goal of thriving in our habitats and communities.

change and its impacts do not necessarily fall like dominoes in a predictable linear pattern; rather, each climate change impact creates more of a ripple effect. Picture one component of climate change – rising temperatures, for example – as a pebble tossed into a pond. Watch the ripples spread outwards in concentric circles, affecting a greater area than the point of impact. Now imagine a handful of pebbles – heavier rains, less lake ice, reduced soil moisture – and watch the circles spread, intersect and overlap.

Because climate impacts play out differently from place to place and over time, and because human and ecological systems adapt at multiple scales of time and place – sometimes simultaneously – conflict is inherent in the process of forming adaptation strategies. Some may gain and some may lose as our climate changes, and there will be cases that require us to make value decisions while making management and policy decisions.

Earth's climate is changing, and myriad physical and biological responses to this change are manifest in our landscapes, oceans and atmosphere. These responses to and effects of climate change have an impact upon our natural and human environments in a variety of ways.

Climate change is a complex phenomenon. The cause-and-effect relationships of climate

Because climate impacts play out differently from place to place and over time, and because human and ecological systems adapt at multiple scales of time and place – sometimes simultaneously – conflict is inherent in the process of forming adaptation strategies.

Frameworks for Understanding

An appropriate framework within which to discuss climate change adaptation is that of risk management, where decision-makers weigh the likelihood of an event against the consequences that could result from that event. The impacts identified throughout this report are likely to occur with a given probability, and if they do happen, they will result in either harms or benefits. Managers and policy-makers must rely on the probabilities of the impacts occurring as well as the degree of harm or benefit that is expected to result when making decisions about how and when to adapt to specific climate impacts.

Building societal and environmental resilience is a way of reducing risk and an overarching adaptation strategy to respond to climate change. Stakeholders can increase resilience either by creating a distinct process to address climate impacts or by “mainstreaming,” a process in which climate is incorporated into other related decisions and topics. For example, existing programs and policies in community planning or urban design can be reviewed in light of climate change. Those current programs and policies can then be given adequate priority and implemented with the intent of building environmental resilience.

The framework of risk management can provide guidance to managers and decision-makers when confronting climate change, and it includes several principles of adaptation (discussed in more detail in Chapter 8: *Implementing Adaptation*) that can be relied upon. Here we highlight three principles that can help stakeholders determine where to get started and how and when to act: triage, the precautionary principle and “no regrets.”

When managing natural systems, triage involves identifying resources, habitats or species where 1) the negative impacts are inevitable even with intensive intervention, 2) species will withstand climate impacts without the need for management, and 3) the success of adaptation will depend on the type



Photo: Avery Dorland



and amount of management. It would be most effective, then, to direct management efforts at that third group of resources, which might include a particular trout stream or stretch of coastline.

The precautionary principle addresses the reality that, sometimes, if we wait for certainty in predictions, it is too late to prevent a negative impact on an important resource, habitat, species or community. Human and natural communities have always adapted to changes in their environments, but the rate and scale of current and projected climate change necessitate that we be strategic in how we adapt – for instance, acting when the probability may be low but the risk is high. While we adaptively manage the impacts we currently experience from climate change, we must also anticipate impacts yet to come and adapt proactively. We can develop and implement adaptation strategies before the climate changes occur by taking a “better safe than

sorry” approach in cases where the consequences of an event are known even though the details of the causes and effects are not yet fully understood.

“No regrets” strategies are management practices that both increase resilience in a changing climate and bring benefits regardless of climate projections. This involves reducing existing threats, building capacity in the public and private sectors, and expanding outreach and education on the impacts of climate change in Wisconsin. For example, climate change may prompt managers to implement practices that increase the resilience of a habitat – by protecting biodiversity and the integrity of the environment, both of which have value in the present. Thus there are “no regrets” in implementing or continuing these practices.

These three options are not the only approaches a risk management framework can provide; however, they



Photo: Avery Dorland



Photo: Darren Bush



Photo: Darren Bush



Photo: Darren Bush



illustrate the value of thinking about climate change adaptation in terms of risk. Adaptation to climate change is a complex and difficult problem. By thinking in terms of risk, we can more easily grasp the scope of the problem and make it more manageable for individual decision-makers. For instance, although a triage approach will not address all aspects of climate change, it will help us focus on the most urgent and tractable aspects.

A number of tools, policies and practices are already in place in the field of natural resource management and community planning that will be valuable in reduc-

ing the negative impacts of climate change and taking advantage of any climate impacts that may benefit the state. It is imperative that managers and policy-makers evaluate the effectiveness of these options in light of expected climate change. We can leverage existing problem-solving systems by “mainstreaming” – a strategy in which we incorporate climate change issues into other decision-making processes. Mainstreaming is not about risk management but, rather, about efficient policy implementation. We are already working on problems related to the environment, and we cannot consider climate change in isolation from other issues.

RISK MANAGEMENT

Risk Characterization

Understanding how climate-related hazards could injure people, damage property, interrupt services, alter natural habitats or cause species loss is essential in developing strategies to reduce vulnerability by strategically targeting efforts to manage potential risk. The Federal Emergency Management Agency defines risk assessment for the built environment as “the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards by assessing the vulnerability of people, buildings, and infrastructure to natural hazards.” And the U.S. Environmental Protection Agency defines ecological risk assessment as “the process for evaluating how likely it is that the environment may be impacted as a result of exposure to one or more environmental stressors such as chemicals, land use change, disease, invasive species and climate change.”

Risk characterization identifies potential hazards to which a community, business, or institution is susceptible and estimates the potential consequences of these hazards to physical, social, and economic assets. Risk characterization also determines which areas are most vulnerable to damage from these hazards and quantifies the resulting cost of damages or costs avoided through future hazard mitigation. The potential impacts of flooding, heat waves, drought and other climate-related hazards in Wisconsin include:

- Public utility and service outages.
- Building losses and other property damage.
- Disrupted business operations.
- Human illness and disease.
- Agricultural crop losses from pests and diseases.
- Loss of biodiversity and ecosystem degradation.
- Polluted runoff damaging lakes and streams during storms.

Finally, risk characterization also analyzes the potential effectiveness of risk management, emergency response, and business continuity plans. These evaluations may identify needed insurance or financing to mitigate the financial impacts of climate-related losses.

Hazard Mitigation Planning

Hazard vulnerability assessments can play an important role in local land use planning and zoning processes. Community comprehensive plans, with hazard mitigation elements and effective land use policies, can reduce insured losses to property and avoid repeated losses to vulnerable properties and infrastructure. Legislative and executive bodies in state and local government can also examine their roles in creating incentives that decrease community vulnerability to climate-related hazards. As climate-related hazards and potential impacts increase in severity and become better understood, one might reasonably assume that efforts will be made to reduce risk and increase preparedness. Consequently, public sector fiscal constraints could lead to policy changes that curtail or substantially reduce government financial subsidies for development in areas at risk from natural hazards. Current federal subsidies include the National Flood Insurance Program, beach nourishment programs, tax benefits for second homes, and subsidies for infrastructure projects constructed in areas at risk from natural hazards.



WICCI and Adaptation

For the purpose of this report, WICCI relies upon the definition of adaptation put forth by the Intergovernmental Panel on Climate Change:

Adaptation is the “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”

Adaptation can occur on a small or large scale. For example, individual people can adapt, or adaptation can take place at a regional or industry-wide level. Some strategies presented throughout this report can occur at a statewide level, and others are more appropriate for local communities or geographic areas to implement. Likewise, adaptation can happen at different time scales. Sometimes adaptation necessitates quick action, and other times circumstances such as the certainty of the science, the degree of urgency, and the cost or feasibility require us to plan decades in advance.

The goal of WICCI in producing this report is to identify the impacts of climate change in Wisconsin through vulnerability assessment and to inform the implementation of appropriate adaptation strategies. In the upcoming chapters of Section 2: *Impacts*, we describe the ways in which climate change is impacting and will likely continue to impact our natural and built environments throughout the state. In each chapter, we present adaptation strategies put forth by the contributing scientific working groups. In order to guide readers through the purposes of these strategies and illustrate their expected outcomes, we present them in four general categories:

Taking action to adapt to future climate: Strategies that have a clear present benefit, while creating resilience for adapting to the future, are preferred. This category includes natural

systems management choices, social systems improvements and infrastructure modifications that provide both a climate adaptation benefit and present societal or ecosystem benefit. (Example: Increasing urban green space, thus reducing stormwater runoff while mitigating the heat island effect.)

Building capacity to make better decisions: A better understanding of climate science, impacts and adaptation strategies is needed along with tools for resource managers and other decision-makers. This category includes applied research, developing local modeling and management frameworks, implementing new management techniques at the local and program level, and training and education on using new tools for resource managers and others. (Example: Integrating climate adaptation strategies into local community planning activities such as stormwater management to prevent damaging runoff or flooding.)

Communicating with stakeholders: Education about the risks from future climate change and the need for policies and planning that will maintain society’s flexibility for adapting to new and future impacts is fundamental to successful adaptation. This category includes communication with the public, decision-makers, community groups, local governments, nonprofits and others about impacts from climate change and the benefits of adaptation. (Example: Educating communities about the hazards of building in areas prone to flooding.)

While adaptation is not a substitute for mitigation, which aims to reduce the rate at which greenhouse gases enter the atmosphere, we do need to adapt to the climate change impacts we are facing today and devise adaptation strategies we can implement in anticipation of impacts we are likely to see in the future.



Filling gaps in our understanding: Our knowledge about how natural and human systems will respond to climate change is incomplete. This category includes scientific research, establishing long-term data-gathering programs, improving climate modeling and learning from climate adaptation efforts in other states. (Example: Creating a network of monitoring stations for rainfall and stream flows.)

Adaptation is the “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”

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

The strategies proposed by the WICCI working groups in each of the upcoming chapters in Part 2: *Impacts* are not a prescription for successfully meeting the challenges of our changing climate. Rather, they represent the best ideas for adapting to the climate impacts upon Wisconsin’s natural and built environments, developed with the climate knowledge available today. We expect that future work will improve upon and expand the range of these preliminary ideas.



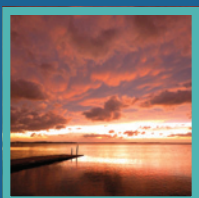
PART 2:

IMPACTS





Impacts and Vulnerabilities



Adaptation Strategies

Wisconsin boasts a wealth of water resources. The Mississippi River, Lake Superior and Lake Michigan help define our state borders, and the 84,000 miles of streams, 15,000 lakes, 5.3 million acres of wetlands and abundant groundwater nourish plants and animals, provide drinking water for urban and rural communities, support industry and agriculture, and enrich our recreational activities.

Wisconsin's climate is changing, and our water resources and aquatic ecosystems are changing, too. In this chapter, we will examine the ways in which climate change affects the quality and quantity of water resources, including inland lakes, rivers and streams, groundwater and wetlands. We will describe the physical responses within the water cycle to rising temperatures and shifting precipitation patterns, discuss the impacts of those changes, and present adaptation strategies where possible. (For discussion of impacts on the Great Lakes, see Chapter 6: *Coastal Resources* and Chapter 9: *Moving Forward*.)

Wisconsin's Water Resources

Wisconsin's waters respond to climate through a range of processes and, in some cases, serve as indicators of climate change. Historical records demonstrate that water resources are intimately linked to local and regional climate conditions. Long-term records of lake water levels, lake ice duration, groundwater levels, stream baseflow, and stream and river flooding have corresponding relationships with long-term trends in atmospheric temperature and precipitation.

Photo: Judith Kozminski