WATERSHED SCIENCE BULLETIN

Journal of the Association of Watershed & Stormwater Professionals

A program of the Center for Watershed Protection, Inc.

AWSPs Association of Watershed & Stormwater Professionals

SPRING 2011

Integrating Climate Change Science into Watershed and Stormwater Management

TABLE OF CONTENTS

FEATURED CONTENT

BULLETIN DEPARTMENTS

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This photo was taken along Young's Bay estuary in Astoria, OR. The Young's Bay estuary is a component of the Columbia River estuary, a nationally significant estuary in the northwest corner of Oregon that supports some of the largest anadromous fish runs in the world and provides unique habitat for sensitive and endangered species.

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Adaptation Strategies To Address Climate Change Impacts on Wisconsin's Water Resources

Wisconsin's water resources are an important part of what defines the state and its people. The Mississippi River, Lake Superior and Lake Michigan, about 135,000 km (84,000 mi) of streams, 15,000 lakes, 2.1 million ha (5.3 million acres) of wetlands, and a plentiful, though finite, supply of groundwater support industrial and agricultural activities and enrich our recreational opportunities.

In February 2011, the Wisconsin Initiative on Climate Change Impacts (WICCI) released its first climate change adaptation strategy report. A statewide collaborative effort, WICCI focuses on adaptation strategies and how to prepare for climate change proactively at state and local levels rather than focusing on the mitigation of greenhouse gases. The project is a partnership among the Wisconsin Department of Natural Resources, the University of Wisconsin, and other state agencies and institutions. WICCI has more than a dozen working groups composed of hundreds of scientific experts and stakeholders that have been charged with developing risks, vulnerabilities, and adaptation strategies related to Wisconsin's changing climate (Figure 1). This vignette highlights the WICCI findings on water resources.

Figure 1. The Wisconsin Initiative on Climate Change Impacts is made up of hundreds of experts across multiple agencies, institutions, and disciplines.

The Climate Working Group of WICCI developed future climate forecasts by downscaling 14 global climate models to the state level. One of the first efforts of this kind in the country, this modeling was possible because of the availability of long-term, fine-scale weather data in Wisconsin. Researchers predict that the state's average annual temperature will warm by 2°C and 5°C (4°F and 9°F) by the middle of the century, with warmer winters and warmer nights.

Precipitation changes are more difficult to predict, but researchers expect less precipitation in the form of snow. Winter and spring precipitation is likely to increase by about 20%. As air and water temperatures increase, we can expect to see longer ice-free periods and increased potential evaporation. Storm intensities are expected to increase, with slightly more frequent events of greater than 5.1 cm (2 in) of precipitation in a 24-hour period.

Climate scientists also analyzed seasonal and annual precipitation and temperature data from 1950 to 2006 to document historic climate changes. Our climate has changed, and an analysis of historic water resources data shows that water resources are intimately linked to regional climate conditions that are also changing.

Robust data sets of ice cover dating back to the 1850s show that average ice cover has decreased by about 20% in southern Wisconsin, reflecting warmer temperatures. Lake levels in northern Wisconsin have gradually decreased and are currently at the lowest levels in the 70-year record. In the southern part of the state, water levels appear to have increased since the 1960s. Changes in both ice cover and water levels parallel other historic and ongoing climate changes statewide.

Mean annual stream baseflow has increased overall statewide by about 14% over the past 56 years, consistent with a 10%–15% increase in precipitation over the same time period (Figure 2).

Using the historical databases and the climate projections, water resources specialists identified the major impacts of climate change on water resources. Through a series of workshops, WICCI's Water Resources Working Group (WRWG) then developed several adaptation strategies to address these impacts. The six major impacts and adaptation strategies that WRWG has identified thus far are as follows.

Increased flooding will have impacts on infrastructure and agricultural land. Identify, map, and prioritize potentially restorable wetlands in floodplain areas; restore prior-converted wetlands in upland areas to provide storage and filtration; mitigate storm flows and nutrient loading downstream; and develop both long-term and short-term changes to community infrastructure.

Harmful blue-green algal blooms will occur more frequently with increased summer temperatures. Increase monitoring of inland beaches and develop better prediction tools for blue-green algal toxins and associated changes in water quality to improve predictive capacity. Develop statewide standards for blue-green algal toxins and take appropriate action to protect public health.

Demand for water and groundwater extraction will increase as a result of precipitation projections and warmer growing season temperatures. Encourage major water users such as power plants to locate in areas with adequate and sustainable water sources, including large rivers or the Great Lakes; encourage rural and urban water conservation through incentives and regulation; and promote integrated water management by planning water use based on long-term projections of supply and demand and by tying water use to land use and economic growth forecasts.

Seepage lakes will change as a result of variable precipitation, recharge, or increased potential evapotranspiration with additional implications for water chemistry, habitat, and shorelines. Enhance and restore shoreline habitat (using, for example, coarse wood, littoral and riparian vegetation, or bioengineered erosion control) to withstand variations in water levels; in headwater areas or near watershed divides, enhance infiltration by reducing impervious surfaces in urban and riparian areas and changing land management practices; change planning and zoning for lakeshore development to account for changes in water levels; and adjust and modify expectations and uses of lakes, especially seepage lakes, by recognizing that some lakes are not suited for all uses.

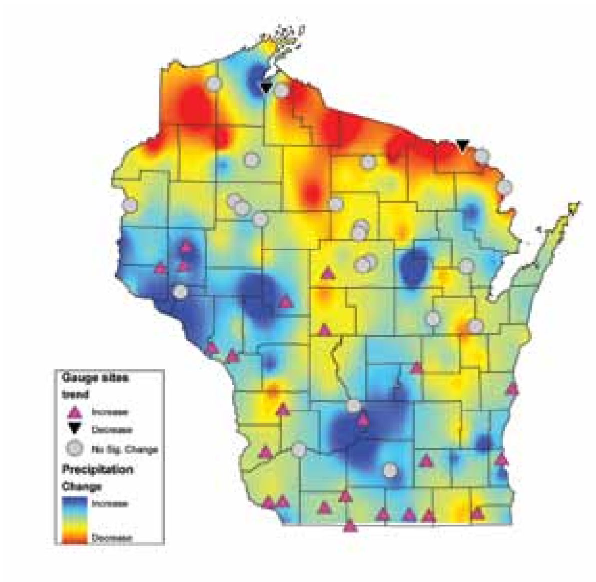

Figure 2. From 1950 to 2006, Wisconsin as a whole has become wetter, with an increase in annual precipitation of 7.9 cm (3.1 in). This observed increase in annual precipitation has primarily occurred in southern and western Wisconsin, while northern Wisconsin has experienced some drying. The southern and western regions of the state show increases in baseflow, corresponding to the areas with the greatest precipitation increases. Map prepared by Eric Erdmann, Wisconsin Department of Natural Resources, in 2010. Sources: Greb and Kucharik et al. (2010)

Sediment and nutrient loading will increase as a result of earlier and more intense spring runoff events. Resize manure storage facilities, wastewater facilities, stormwater drains, and infrastructure to accommodate increased storm flows to protect water quality; reverse the loss of wetlands; restore prior-converted wetlands to provide storage and filtration by mitigating storm flows and nutrient loading; protect recharge and infiltration areas and riparian buffers to reduce overland flow of polluted runoff; and incorporate water management strategies based on climate projections into farm-based nutrient management plans.

The spread of aquatic invasive species is likely to increase. WRWG continues to develop adaptation strategies for this projected change.

WRWG is moving into the next phase of implementation and has already defined and funded new research priorities and projects, along with discussions to modify water quality monitoring programs to address climate change at the state and watershed levels. In addition, WRWG is developing outreach and education strategies.

A separate working group has dealt with stormwater; its report is available on the WICCI website.

List of Sources

Greb, S. R. No date. Historic trends in flows of Wisconsin's rivers and streams. Unpublished data. Madison, WI: Wisconsin Department of Natural Resources.

Kucharik, C. J., S. P. Serbin, S. Vavrus, E. J. Hopkins, and M. M. Motew. 2010. Patterns of climate change across Wisconsin from 1950 to 2006. *Physical Geography* 31(1):1-28.

Magnuson, J. J., J. T. Krohelski, K. E. Kunkel, and D. M. Robertson. 2003. Wisconsin's water and climate: Historical changes and possible futures. In *Wisconsin's waters: A con-*

fluence of perspectives, ed. C. Meine, 23–36. Madison, WI: Wisconsin Academy of Sciences, Arts and Letters.

Wisconsin Initiative on Climate Change Impacts. 2011. *Wisconsin's changing climate: Impacts and adaptation*. Nelson Institute for Environmental Studies, University of Wisconsin-Madison and the Department of Natural Resources, Madison, WI.

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A Climate Change Action Plan for the Florida Reef System

The Florida Reef System is the third-largest coral reef ecosystem in the world, spanning more than 556 km (300 nautical mi) from Martin County, Florida, on the Atlantic coast, south through the Keys, to the Dry Tortugas (Figure 1). It includes a rich diversity of sensitive coral habitats ranging from hardbottom, nearshore patch reefs to reef flats to deep and outlier reefs, as well as associated seagrass, beach, and mangrove habitat. For decades, overfishing, land-based pollution, and direct habitat degradation from human activities—along with climate-related threats, such as extreme water temperatures and ocean acidification—have threatened this system (Figure 2).

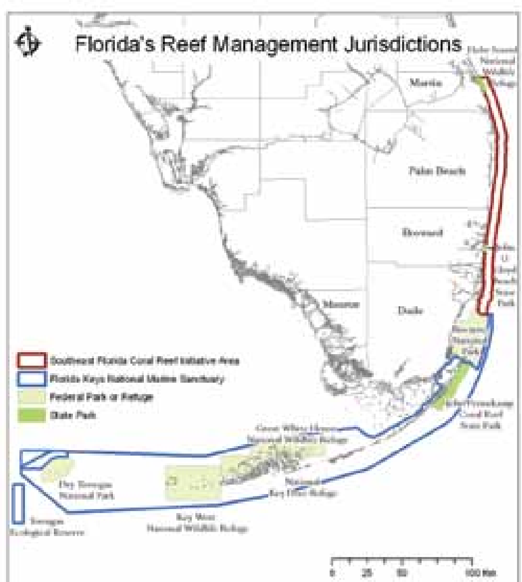

Figure 1. The extent of the Florida Reef System with respect to Florida's reef management jurisdictions. Map courtesy of The Nature Conservancy.

The Florida Reef Resilience Program (FRRP), established in 2004 in response to these threats, brings together diverse interests, expertise, and management authorities. The FRRP evolved organically across disciplines, user groups, and resource management entities that leveraged resources and focused efforts on the emerging challenges. A steering committee representing fishing, diving, science, management, and the environmental community spearheaded the development of a holistic five-year plan: the *Climate Change Action Plan for the Florida Reef System 2010–2015*.

The plan is designed to accomplish three main goals (1) increase reef resilience through active management, (2) reduce impacts from reef-dependent communities and industries via outreach and adaptation planning, and (3) execute targeted research. It outlines a coordinated response to climate change–related threats, including efforts by state, federal, and local partners working across political, social, and jurisdictional boundaries. Built on well-established principles for helping corals resist, tolerate, and recover from negative impacts, the plan describes actions that reef managers can undertake, in collaboration with stakeholders and other partners, to minimize the damage and associated impacts caused by climate change on reefs and reef-dependent industries, such as tourism and fishing.

The plan includes a range of detailed recommended actions addressing outreach, social resilience, research, and management which, if implemented, should increase the overall resilience of the entire Florida reef system. Top actions include the following:

- Continue and expand the FRRP disturbance response monitoring.
- Implement a marine zoning plan that incorporates resilience and connectivity between reefs.
- Include sea level rise adaptation and mitigation planning in local land use comprehensive plans.
- Evaluate and revise existing monitoring programs to optimize their effectiveness in the context of climate change
- Decrease negative user impacts.
- Target outreach across sectors.