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REPORT IN BRIEF

# Progress Toward Restoring the Everglades
## The Third Biennial Review, 2010

**Although the progress of environmental restoration projects in the Florida Everglades remains slow overall, there have been improvements in the pace of restoration and in the relationship between the federal and state partners over the last two years. However, the importance of several challenges related to water quantity and quality have become clear, highlighting the difficulty in achieving restoration goals for all ecosystem components in all portions of the Everglades. Rigorous scientific analyses of the tradeoffs between water quality and quantity and between the hydrologic requirements of Everglades features and species are needed to inform future prioritization and funding decisions.**

Shaped by the slow flow of water from Lake Okeechobee to Florida Bay, the Everglades was once a large and diverse aquatic ecosystem with millions of acres of wetlands, sawgrass plains, ridges, sloughs, and tree islands that provided sanctuary to a rich array of plant and animal life. However, over the past century, the construction of an extensive network of canals and levees for flood control, water supply, agriculture, and urban development has dramatically altered the region's landscapes and diminished natural resources, reducing the area of the Everglades by roughly 50 percent. The remnants of the Everglades now compete for vital water with urban and agricultural interests and are impaired by contaminated runoff from these two activities.

**Figure 1.** Canals and levees have radically altered the flow of water in the Everglades, and development has reduced the area of the ecosystem by half. Source: David Policansky, NRC

Concerns about declines in the environmental quality of the Everglades led to the initiation of the Comprehensive Everglades Restoration Plan (hereafter the Restoration Plan) in 2000. The goal of this multi-decadal effort is to reestablish the hydrologic characteristics of the Everglades with a water system that simultaneously meets the needs of both the natural and human systems of South Florida.

As part of Congress's mandate in the Water Resources Development Act of 2000, and with support from the U.S. Army Corps of Engineers, the Department of the Interior, and the state of Florida, the National Research Council convened a committee to conduct a series of biennial evaluations of progress toward achieving the natural system restoration goals of the Restoration Plan. The last review of the restoration, in 2008, found that only scant progress towards restoration goals had been made, and that the project was mired in budgeting, planning, and procedural matters. In this third biennial review, the committee reaffirms its predecessor's conclusions that continued declines of some aspects of the ecosystem make accelerated progress in the Everglades even more important.

### Restoration Progress

The Restoration Plan has made tangible progress over the last two years. Federal funding has increased, which has allowed continued progress as state funding has declined. Four Restoration Plan projects are now under construction, and pilot projects are addressing

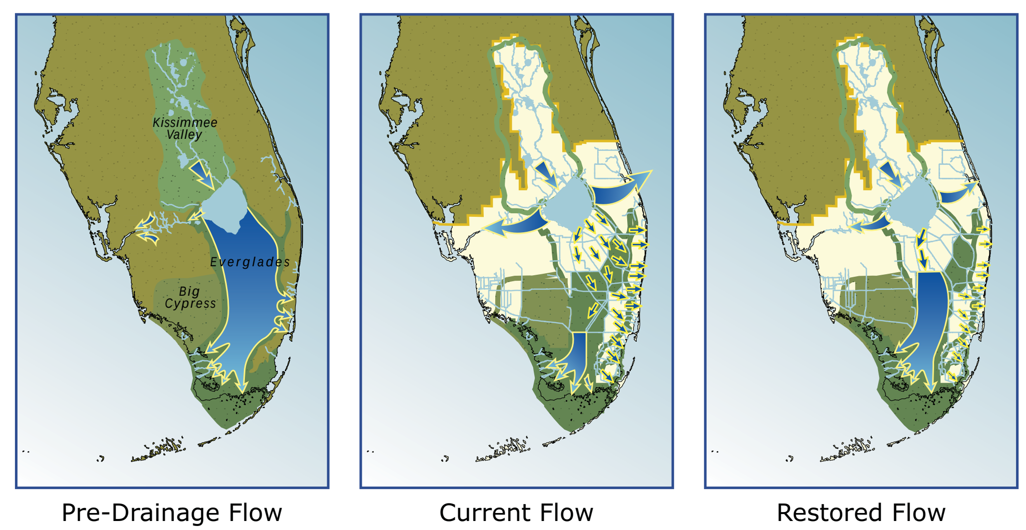


**Figure 2.** Water flow in the Everglades under (*a*) historical conditions, (*b*) current conditions, and (*c*) conditions envisioned upon completion of the Restoration Plan.

Source: South Florida Water Management District

important design uncertainties. Also, several projects that serve as foundations to the Restoration Plan are under construction, notably a 1-mile Tamiami Trail bridge to improve flow under the trail. After years of delay, it is now critically important to maintain this momentum to minimize further degradation of the system.

## Challenges to Restoration Progress

At the heart of Everglades restoration is the goal of "getting the water right" by re-establishing the quality, quantity, timing, flow, and distribution of water to support the biological characteristics that defined the Florida Everglades before the construction of canals and levees. These defining characteristics include interconnected wetlands, extremely low concentrations of nutrients in the water, productive estuaries, resilient plant life, and thriving populations of native wildlife.

In practice, "getting the water right" means re-engineering the canals and levees of Central and South Florida to more closely mimic historic freshwater flows in the South Florida ecosystem. Restoration at this large scale involves many uncertainties, constraints, and tradeoffs, such as restoring hydrologic conditions with sufficient water flow while meeting water-quality goals.

### *Improving Water Flow Throughout the Everglades*

The construction of canals and levees to drain the Florida Everglades radically altered the way that water flows through the region (see Figure 1 for an example). Historically, the primary sources of water in the Everglades were rainfall and occasional overflows of Lake Okeechobee. Surface water spread out and soaked into the peat covered landscape, before flowing slowly south. Over the last century, water management projects have cut off the connection between Lake Okeechobee and the areas to the south and greatly altered the natural flow of water through the system. Urban and agricultural development and peat subsidence have further diminished the water storage capacity of the ecosystem.

Increasing the amount of water stored in the Everglades is a major near-term priority for the Restoration Plan. However, the reduced area and water storage capacity of the ecosystem mean that restoration benefits will be distributed unevenly across the Everglades landscape. Hydrologic conditions may even worsen in some areas in order to achieve the desired outcomes in other areas.

Nearly all Everglades restoration projects carry tradeoffs. Understanding the tradeoffs from a whole ecosystem perspective is critical to decision-making. Improved models and decision tools are needed to help policy makers weigh the effects of restoration projects on multiple ecosystem components, such as habitat conditions, species, and critical ecosystem processes and features such as tree islands, and this information should be clearly communicated to planners and stakeholders.

### *Challenges in Restoring Water Quality*

Improving water quantity and flow in the Everglades is closely linked to the challenge of restoring water quality. Restoration planners cannot design projects to move large quantities of water into the Everglades without first ensuring that the water will meet established water quality criteria. Meanwhile, getting the water quality right has proven to be more difficult than originally imagined. Historically, the nutrient content of the water in the Everglades ecosystem was low, but agricultural operations and runoff have increased the amount of phosphorus that enters the Everglades. As a result, attaining water quality goals and has become a central technical, legal, and policy challenge that is affecting Restoration Plan progress. Improving water quality throughout the ecosystem is likely to be very costly and take several decades of commitment to system-wide integrated planning and design efforts that simultaneously address nutrient source controls, storage, and treatment over a range of time scales.

Stormwater treatment areas— constructed wetlands that remove nutrients and other contaminants from the water— are the primary means of treating water entering the Everglades. However, the current acreage of stormwater treatment areas is not sufficient to treat existing water flows and phosphorus loads into the ecosystem. With the increased water flows envisioned as part of the Restoration Plan, it's been estimated that an additional 54,000 acres of stormwater treatment area would be needed. Construction alone would cost approximately $1.1 billion, and an additional $27 million per year would be required to operate the treatment areas. A further $1.1 billion could also be needed to refurbish the treatment areas every 20 to 25 years.

Other options include increasing pollution control practices on agricultural lands to reduce the amount of land needed for stormwater treatment areas, but such actions might also compromise the revenue of agricultural operations. A comprehensive cost effectiveness analysis should be conducted to inform decision making and optimize restoration outcomes given fiscal constraints.

Research and analysis is needed to address the sustainability and performance of the stormwater treatment areas and to improve the efficacy of phosphorus source controls (also called best management practices). These practices include sediment and erosion control measures and improved irrigation management.

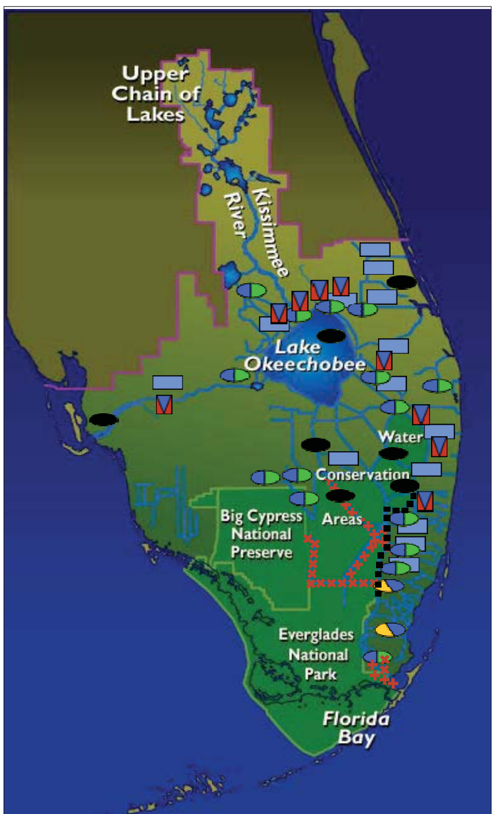


**Figure 3.** Major components of the Restoration Project.

Source: Courtesy of Laura Mahoney, USACE

## Balancing Two Goals

Given that the restoration originally envisioned by the Restoration Plan remains decades away, rigorous scientific analyses are needed to examine the consequences of tradeoffs between water quality and quantity in the Everglades ecosystem. These tradeoffs can be produced deliberately or as unintended consequences of project sequencing.

Although the committee is not endorsing any particular tradeoffs, research is needed to understand the repercussions of water management decisions in order to inform future water management strategies, such as the prioritization of projects. Understanding and communicating these challenges will be critical to maintaining political and public support for the Restoration Plan – support that is essential to sustain this lengthy and costly process. In particular, analysis is needed to answer the following questions:

- What are the short- and long-term consequences of providing reduced water quantities but maintaining sufficient water quality?
- What are the short- and long-term consequences of providing reduced water quality to the ecosystem but maintaining sufficient flows?
- Are the negative consequences reversible, and if so, on what time frames?

## Science and Adaptive Management

Linking science to management decisions is critically important to achieve restoration goals, but the effectiveness of current mechanisms has come under question by some in the restoration community. The committee encourages Restoration Plan leadership to examine this issue and consider mechanisms to improve the communication of relevant scientific findings to decision makers.

### *Box 1. Advances in Science to Support Decision Making: The Importance of Flow to the Ridge and Slough*

The physical surface of the Everglades is a mosaic of sawgrass ridges separated by deeper water sloughs, together known as ridge and slough topography. Tear-drop shaped tree islands are roughly aligned with the ridges and sloughs, and are scattered throughout the landscape.

Only in the last few years have researchers begun to generate a clear understanding of how the distinctive Everglades landscape formed and is maintained. This research has fundamentally changed the conceptualization of the Everglades system from a set of separate plant communities to an interlinked peat-based system in which flow, the very low nutrient content of surface water, and the interaction of different plant communities shaped the characteristic forms of the landscape. As restoration planners now consider the potential benefits and costs of different designs for increasing water flows to the south, this is an illustration of the application of scientific understanding to inform restoration goals and management decisions.


**Figure 4.** Ridge and slough landscape in its pre-drainage condition. Note sharp, distinct edges on most sawgrass ridges, and the open water of sloughs. Photograph taken by explorer John King in March 1917.

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The National Academies appointed the above committee of experts to address the specific task requested by Congress. The members volunteered their time for this activity; their report is peer-reviewed and the final product signed off by both the committee members and the National Academies. This report brief was prepared by the National Research Council based on the committee's report.

EXPERT CONSENSUS REPORT

For more information, contact the Water Science and Technology Board at (202) 334-3422 or visit http://dels.nas.edu/wstb. Copies of *Progress Toward Restoring the Everglades: The Third Biennial Review, 2010* are available from the National Academies Press, 500 Fifth Street, NW, Washington, D.C. 20001; (800) 624-6242; www.nap.edu.