NATIONAL ACADEMY OF SCIENCES
NATIONAL ACADEMY OF ENGINEERING
INSTITUTE OF MEDICINE
NATIONAL RESEARCH COUNCIL

REPORT IN BRIEF

WATER SCIENCE AND TECHNOLOGY BOARD
BOARD ON EARTH SCIENCES AND RESOURCES
JUNE 2014

Progress Toward Restoring the Everglades: The Fifth Biennial Review, 2014

DESPITE EXCEPTIONAL PROJECT PLANNING accomplishments, over the past two years progress toward restoring the Everglades has been slowed by frustrating financial and procedural constraints. The Central Everglades Planning Project is an impressive strategy to accelerate Everglades restoration and avert further degradation by increasing water flow to the ecosystem. However, timely authorization, funding, and creative policy and implementation strategies will be essential to realize important near-term restoration benefits. At the same time, climate change and the invasion of nonnative plant and animal species further challenge the Everglades ecosystem. The impacts of changing climate—especially sea-level rise—add urgency to restoration efforts to make the Everglades more resilient to changing conditions.

One of the world's ecological treasures, Florida's Everglades once encompassed about 3 million acres stretching from Lake Okeechobee to Florida Bay, and supported a rich array of plant and animal life. But 19th century investors dreamed of converting the Everglades wilderness into an area of cities and high agricultural productivity. Over the past century the ecosystem has been greatly altered by an extensive water control infrastructure designed to provide flood control and water supply for urban and agricultural development. Today, the remnants of the original Everglades compete for vital water with urban and agricultural interests and are impaired by contaminated runoff from these two activities.

The Comprehensive Everglades Restoration Project (CERP), a joint effort led by the state and federal governments and launched in 2000, seeks to reverse the general decline of the ecosystem. The project was originally envisioned as a 30- to 40-year multi-billion dollar effort to restore the hydrologic characteristics of the Everglades and to create a water system that serves the needs of both the natural and the human systems of South Florida. This report is the fifth in a series of biennial National Research Council reports that review the Comprehensive Everglades Restoration Project's progress toward restoring the natural system.

PLANNING PROGRESS

Most CERP progress has been focused on the edges of the historic Everglades — and as a result, ecosystem declines continue in the central Everglades. Reasons for this sequencing of projects are complex, but include fewer stakeholder conflicts at the periphery of the Everglades, and strong local stakeholder support for specific efforts. Additionally, the project planning process has been easily stalled by scientific

Figure 1. *Photos showing the natural historic Kissimmee River and floodplain in 1954 prior to channelization of the river (*left*), and the same view after canal filling and river restoration (*right*). The filled channel is circled in the right-hand figure. SOURCE: T. Morgan, SFWMD, personal communication, 2013.*

or technical uncertainties, and unresolved water quality issues hindered project plans to increase water flow to the central Everglades.

To address these concerns and expedite restoration of the central Everglades, the Central Everglades Planning Project launched in October 2011. The project prioritizes increments (or components) of a number of CERP projects described in the original restoration plan. The project released a draft regional project implementation report in August 2013, and a final report is expected in summer 2014.

Figure 2. *Freshwater wetland in the Picayune Strand restoration area, with wading birds. Source: USACE (2014a).*

The National Research Council committee reviewed the draft project implementation report, finding that the Central Everglades Planning Project team did an impressive job under a challenging timeframe. The proposed plan seems reasonable and thoughtfully developed with substantial stakeholder input. Implementation of the plan would provide significant benefits to the remnant Everglades ecosystem, including more than 200,000 acre-feet per year of new water flow to the central Everglades, which represents approximately two-thirds of the new water envisioned in the CERP.

The expedited timeframe for developing the draft project implementation report—just 22 months after the Central Everglades Planning Project launched—was extremely challenging for staff and stakeholders alike, given the complexity of the project. Communication within and between agencies was a strength of the expedited process, and the enhanced stakeholder engagement efforts should serve as a model for future planning.

TRANSLATING PLANS TO ACTION

The best-laid plans will be of little benefit if projects are not implemented in a timely manner. To avert further ecosystem degradation, planners and policy makers will need to expedite project implementation in the face of several hurdles. Project authorization, funding, and water quality permitting constraints are currently the largest barriers to timely implementation of the Central Everglades Planning Project. Creative solutions could help expedite restoration, for example by finding permit mechanisms to move clean water into the Everglades prior to completion of the entire Restoration Strategies project. Without such solutions, redistribution of existing water may not be feasible until 2035 or beyond, and at the envisioned funding level of $100 million per year, construction would not be completed for approximately four decades—an exceedingly long timeframe for a system already in significant decline.

IMPLEMENTING RESTORATION PROJECTS

CERP projects with costs exceeding $25 million must be individually authorized by Congress. Water Resources Development Acts have served as the mechanism to congressionally authorize U.S. Army Corps of Engineers projects, and it was assumed the Acts would be passed every two years—but instead, there has been a delay of seven years between passage of the Water Resources Development Act of 2007, and the Water Resources Reform and Development Act of May 2014. The infrequency of Water Resources Development Acts has impeded CERP progress over the past two years.

The availability of funding has caused further lags in CERP progress. There are mandates for 50–50 cost sharing of CERP expenditures between the Federal and State government, but satisfying this requirement has become increasingly challenging for the State amid reduced budgets, mandated expenditures for other projects, and limited project authorizations, which are necessary to credit the state for prior project expenditures. As of September 2013, the state's "creditable expenditures" exceeded those of the Federal government by only $98 million—and as a result, the Federal government significantly reduced spending so as not to exceed the 50-50 cost share by the end of the fiscal year. Passage of the Water Resources Reform and Development Act of 2014 could allow the state to realize approximately $400 million in additional credits for prior spending, thereby easing an impending constraint on federal contributions toward the CERP.

The Integrated Delivery Schedule outlines the CERP construction schedule for the next decade, reflecting priorities of CERP partners—but has not been updated since 2011. CERP planners will need to revisit the Integrated Delivery Schedule with a renewed urgency to advance projects with the greatest potential to avert ongoing ecosystem

degradation and those that promise the largest restoration benefits.

RESTORATION PROGRESS UPDATE

Restoration progress made by CERP project construction to date remains fairly modest in scope. One CERP project—construction of an invasive plant biocontrol facility—and several CERP project components have been completed. Ecosystem responses have been detected after implementation of some project components, for example in the Picayune Strand (see Figure 2) and Biscayne Bay Coastal Wetlands, although many of these improvements are limited. In some cases the scope of the restoration completed is so limited in area that ecological responses are equally small. In other cases additional time may be needed to achieve full ecosystem responses.

Several non-CERP projects have faced bureaucratic and policy issues that hindered implementation progress. Agency disagreements about cost-sharing arrangements affected progress on the Kissimmee River Restoration and the C-111 South Dade project, delaying them for almost two years. Meanwhile, water quality compliance concerns and the lack of an operational plan are preventing realization of restoration benefits in the Mod Waters project. Renewed attention is needed to resolve the remaining bureaucratic challenges to expedite restoration progress.

BUILDING RESILIENCE TO CLIMATE CHANGE AND SEA LEVEL RISE

Climate change and sea level rise present large challenges to Everglades restoration efforts, but they also provide a strong incentive for accelerating restoration. Elevated temperatures and increases in precipitation are likely to change the timing, volume, and quality of freshwater flow and the distribution of species. Furthermore, rising sea level is already causing the intrusion of saltwater to Everglades freshwater habitats and urban water supplies.

Although they challenge restoration efforts, climate change and sea level rise also provide a strong incentive for accelerating restoration. Restoration work provides an important means to mitigate the impacts of the changing environment by enhancing ecosystem resilience. Improvements in Everglades water depths could reduce the impacts of salt water intrusion on urban water supplies and would promote higher rates of peat accretion that could help reduce wetland loss with sea level rise (see Figure 3).

CERP planners should consider the implications of sea level rise and climate change in system-wide planning and project prioritization, designing for flexibility where possible and focusing resources on those projects with the greatest potential to mitigate impacts and provide long-term benefits in the context of sea level rise. Climate change needs to be incorporated into adaptive management planning, at both project-scale and when considering system-wide goals, to incorporate new knowledge and climate and sea-level rise projections as they become available so that managers can adjust future restoration efforts appropriately.

CONSIDERING THE POTENTIAL FOR BIOLOGICAL INVASIONS

Invasions by nonnative species are increasingly common all around the globe and threaten Everglades restoration by displacing native species and transforming ecosystem structure and functioning. Invasions by the melaleuca tree, also known as Australian paperbark, transformed prairies of sawgrass and muhly grass into forests, while Australian pine now dominates formerly treeless beaches. These flammable nonnative plant species can foster frequent hot fires that destroy native plants. Invasive animal and insect species are associated with ecosystem disruption: the Burmese python has quickly spread throughout the Everglades, becoming the top carnivore in the food chain with dramatic declines in mammal populations, and the newly invading redbay ambrosia beetle infects the native swamp bay tree with the deadly laurel wilt fungus (see Figure 4).

Efforts are underway to eradicate nonnative species, with progress in developing coordination at the operational level, although funding remains a challenge. However, there is a lack of coordination at a strategic level and no system-wide mechanism for prioritizing research and management of invasive species. Substantial research is needed to assess

Figure 3. *A sediment elevation table (SET) is used to measure short-term changes in the elevation of the soil surface in an Everglades mangrove forest to better understand the rate of peat accretion or subsidence. Source: USGS.*

the various impacts of nonnative species and to develop or improve control mechanisms. Such knowledge would help inform management actions.

Restoration efforts could, in some cases, help spread invasive species, but until very recently the USACE had not considered invasive species in project planning and implementation (beyond simply removing any invasive species encountered at construction sites). CERP guidance has recently been developed that requires that the potential spread of invasive species is considered in project planning and implementation.

Figure 4. *Laurel wilt damage to swampbay trees on an Everglades tree island. The damage is caused by the laurel wilt fungus, which is carried by the invasive redbay ambrosia beetle (top right). SOURCES: Photographs courtesy E. Allen, SFWMD (*trees*) and J. A. MacGowan, Mississippi Entomological Museum (*beetle*).*

USE OF SCIENCE IN DECISION MAKING

Scientific research provides knowledge and tools that can help decision makers ensure the substantial resources invested in Everglades restoration are being used wisely. Long term monitoring collects data fundamental to understanding how projects are changing conditions. The dramatic 2011 cuts to funding of the Monitoring and Assessment Plan create a risk that adequate long-term data will not be available to assess the system-wide effects of restoration projects. A comprehensive re-evaluation of restoration-related monitoring is needed to determine its adequacy considering budget pressures, the extended CERP implementation timeframes, and the potential impacts of climate change and sea-level rise. There could also be opportunities to reduce the frequency of some monitoring to match the current slow pace of CERP implementation.

Coordination and communication make scientific research and monitoring programs more effective and efficient—but there is no single entity that coordinates scientific study and monitoring related to restoration. The South Florida Ecosystem Restoration Task Force's Science Coordination Group has the broad task of science coordination, but has had limited success in this context. Adequate funding and staff, as well as a clear charge to address critical science needs from a restoration-wide perspective, would help the Science Coordination Group contribute to better science coordination.

Locate additional information, including related reports, at http://dels.nas.edu/wstb
Read, purchase, or download a free PDF of this report at http://www.nap.edu

Committee on Independent Scientific Review of Everglades Restoration Progress: Jeffrey R. Walters (*Chair*), Virginia Polytechnic Institute and State University; **Mary Jane Angelo,** University of Florida; **David B. Ashley,** University of Nevada; **Loretta L. Battaglia,** Southern Illinois University; **William G. Boggess,** Oregon State University; **Charles T. Driscoll,** Syracuse University; **Paul H. Glaser,** University of Minnesota; **William L. Graf,** University of South Carolina; **Stephen G. Monismith,** Stanford University; **David H. Moreau,** University of North Carolina at Chapel Hill; **K. Ramesh Reddy,** University of Florida; **Helen Regan,** University of California, Riverside; **James E. Saiers,** Yale University; **Daniel Simberloff,** University of Tennessee; **Stephanie E. Johnson** (*Study Director, Water Science and Technology Board*), **David J. Policansky** (*Scholar, Board on Environmental Studies and Toxicology*), **Michael J. Stoever** (*Research Associate, Water Science and Technology Board*), **National Research Council**

The National Academies appointed the above committee of experts to address the specific task requested by the Department of the Army, U.S. Department of the Interior, and South Florida Water Management District. 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.

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 Fifth Biennial Review, 2014* are available from the National Academies Press, 500 Fifth Street, NW, Washington, D.C. 20001; (800) 624-6242; www.nap.edu.

Permission granted to reproduce this document in its entirety with no additions or alterations.
Permission for images/figures must be obtained from their original source.

© 2014 The National Academy of Sciences