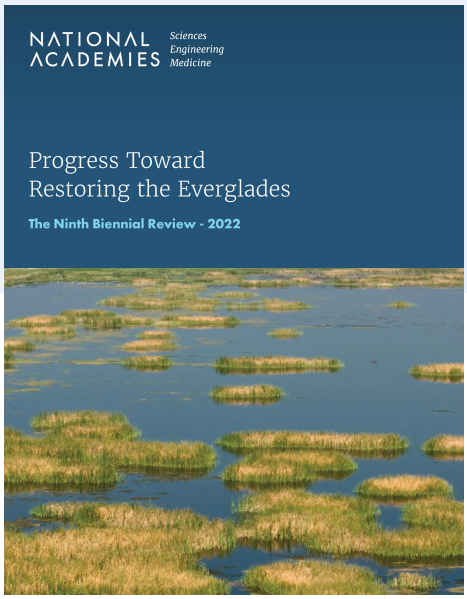
NATIONAL ACADEMIES Sciences Engineering Medicine

Consensus Study Report
Highlights

Progress Toward Restoring the Everglades The Ninth Biennial Review—2022



The Everglades is one of the world's most treasured ecosystems. Its unique landscape, shaped by the flow of slow-moving water, is home to alligators, many kinds of wading birds, and other plant and animal life. Over the past century, a vast network of canals and levees built to improve flood management, urban water supply, and agricultural production has altered the region's wetlands and reduced the Everglades to half its original size.

The Comprehensive Everglades Restoration Plan (CERP) is a multibillion-dollar project launched by the State of Florida and the federal government in 2000 that aims to reverse the decline of the ecosystem. Managed by the U.S. Army Corps of Engineers (USACE) and the South Florida Water Management District (SFWMD), CERP's 68 project components include water storage reservoirs, water quality treatment using constructed wetlands, seepage management, and removal of canals, levees, and other barriers to water flow. Collectively, CERP projects aim to reestablish the natural hydrologic characteristics of the Everglades where feasible and create a water system that serves the needs of both the natural and human systems of South Florida.

At the request of the U.S. Army Corps of Engineers, the National Academies has provided a series of independent assessments of CERP progress since 2004. This ninth report in that series finds that the Everglades restoration program is occurring at a remarkable pace (Figure S-1), thanks in large part to record funding. Several projects are nearing completion in the next 2-3 years, with three additional CERP projects expected to begin construction in the next 2 years. This implementation progress places the restoration at a pivot point, with increasing demands associated with project- and system-wide operation and adaptive management, as well as with planning and implementation of remaining projects.

RESTORATION PROGRESS OVERVIEW

In 2022, six CERP projects are under construction, one project and one major project components have been completed, and several projects are nearing completion. An ambitious proposed implementation schedule (the Integrated Delivery Schedule) is being realized, and the Central Everglades Planning Project (CEPP)—the key project in the restoration of the central Everglades—continues to make impressively rapid implementation progress.

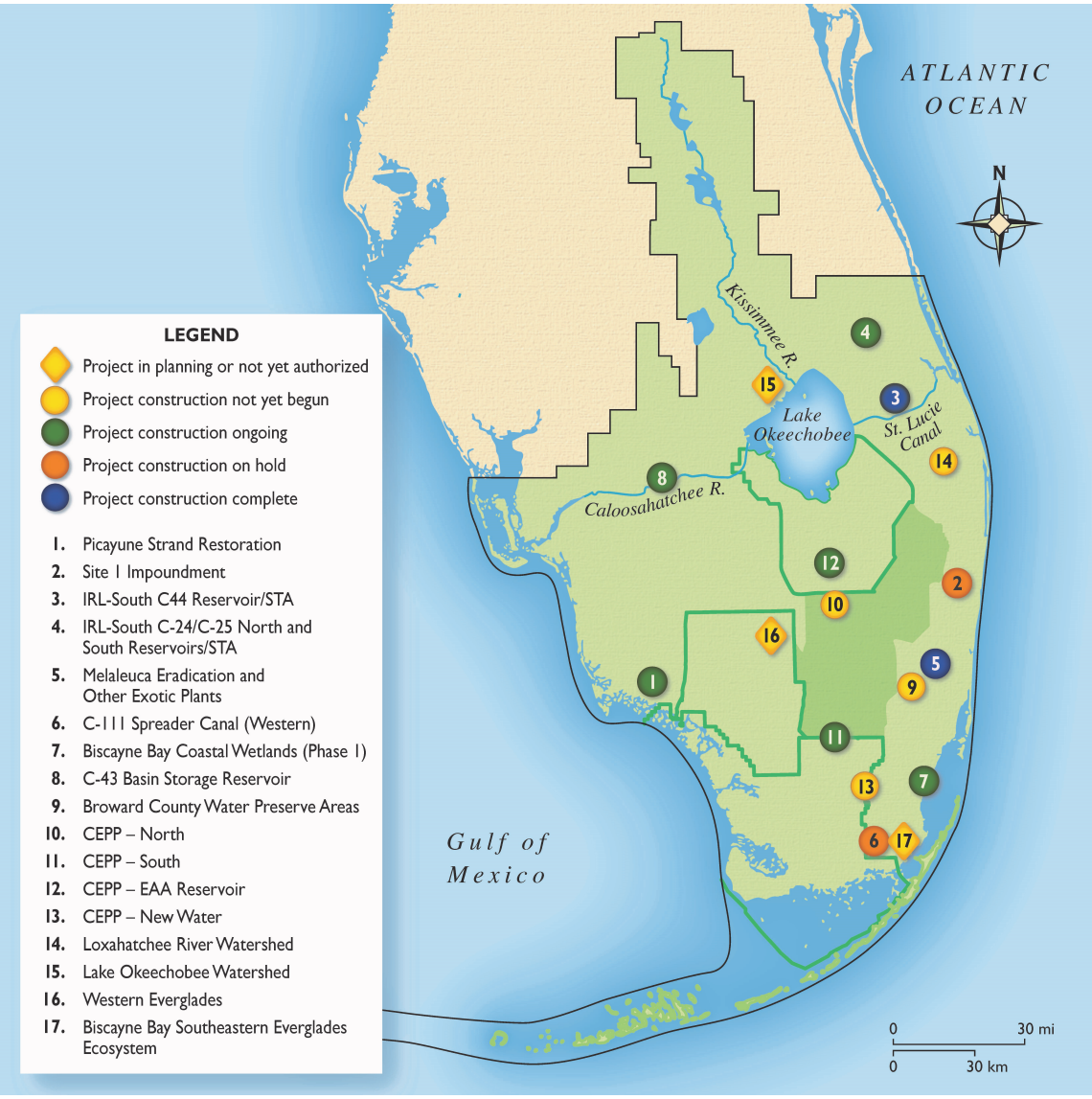


FIGURE 1. Locations and status of CERP projects. SOURCE: International Mapping Associates. Reprinted with permission; copyright 2021, International Mapping Associates.

Hydrologic restoration progress and early vegetation response is evident over large areas of the central and western Everglades after implementation of recent CERP and non-CERP initiatives, with the rehydration of Northeast Shark River Slough in Everglades National Park representing the largest step yet toward restoring the hydrology and ecology of the central Everglades. Signs of progress include increasing hydroperiod (days per year when the soil is waterlogged) and shifts in vegetation in Everglades marl prairies and in Picayune Strand. The pace of current implementation efforts increase the need for and importance of sophisticated strategies to analyze and synthesize natural system responses.

A fundamental objective of Everglades restoration is to capture and store water and then distribute it to sustain ecosystems during dry periods. Progress has been made to clarify the water storage available in the CERP with the completion of new Lake Okeechobee System Operating Manual, which affords water managers the flexibility to use recent data and near-term forecasts to optimize water management. Current plans provide for substantially less storage than originally envisioned in the CERP, which highlights the importance of a CERP mid-course assessment (also known as the CERP Update). The USACE should implement a process for periodic multi-stakeholder review of Lake Okeechobee operations relative to its objectives. An annual or

semi-annual multi-stakeholder meeting would enable periodic assessment of how well competing priorities were balanced, increasing understanding, supporting transparency, and identifying lessons learned in support of adaptive management.

Water quality is an ongoing concern that could potentially constrain progress on several fronts. Increased dry season flows are a specific objective for the Central Everglades Planning Project, but new infrastructure and recent operational changes that have facilitated higher dry season flows have also resulted in total phosphorus exceedances. Better understanding of the underlying processes is needed to assess whether additional steps can help to mitigate these impacts without adversely affecting the intended flow benefits.

STORMWATER TREATMENT AREA (STA) WATER QUALITY AND CERP PROGRESS

Large-scale engineered wetlands, termed stormwater treatment areas (STAs), are used in the Everglades to remove phosphorus so that water delivered to the Everglades meets water quality standards. Implementation and refinement of stormwater treatment areas over the past 3 decades have resulted in marked reductions in phosphorus concentrations. The extent of phosphorus removal varies, and some treatment area discharges remain far from target values. The state's current efforts should continue to improve the function of those areas, although meeting and sustaining the requirements in all of those areas by water year 2027 will be a significant challenge. Given the dependence of CERP progress on attaining the STA water quality effluent limits—particularly the timely delivery of full Central Everglades Planning Project benefits—the report offers recommendations to support the state's ongoing efforts to understand and improve the effectiveness of STAs.

Moving forward, the SFWMD should implement a rigorous adaptive management framework that includes development of near-term milestones for each STA and increasing efforts in data collection, data analysis, modeling, and synthesis to support and attain water quality goals. Most efforts to date in Restoration Strategies aim to improve phosphorus removal efficiency or to increase the overall treatment area, but phosphorus inflow concentrations and loading rates are key drivers affecting outflow concentrations. Without additional progress to reduce inflow loads of phosphorus, the efficiencies of several STAs will need to exceed those of the best performing STA to meet water quality discharge targets. The SFWMD should also consider appointing an independent, external science advisory committee to provide additional perspective and expertise to assist the agency in evaluating water quality progress of Restoration Strategies relative to expectations for phosphorus removal and in identifying areas of concern and promising strategies.

RESTORATION IN THE CONTEXT OF CLIMATE CHANGE

The one near certainty regarding Florida climate change is that temperature and sea level will continue to rise. Increases in sea-level rise will alter the salinity and habitats in coastal and near-coastal regions, and rising air temperature will drive increases in evapotranspiration and decrease runoff unless compensatory changes in precipitation occur. Progress is under way to increase the rigor in which sea-level rise scenarios are considered in CERP project planning, but analytical capabilities are limited by the tools presently available and uncertainty about changes in precipitation and resulting discharge. In contrast, minimal progress is being made in the use of precipitation and temperature scenarios in project planning. No clear signal of the direction of change is not equivalent to an expectation of no change. To help ensure that CERP projects perform reliably under future change and avoid delays and additional costs as the project moves forward, new approaches to climate change analysis should be incorporated into CERP planning and operations in several ways.

Looking ahead, the USACE and SFWMD should proactively develop scenarios of future precipitation and temperature change and develop a strategy to use them to inform future project planning decisions. Existing modeling tools, although effective for many CERP-related purposes, constrain the ability to

improve planning to consider the effects of sea-level rise and other climate change impacts. The USACE and SFWMD should develop improved tools and analytical approaches, such as those that can be used to examine progressive change over time, rather than time slices of future conditions, and examine sensitivity to the magnitude, frequency, and sequence of episodic events. Inadequate consideration of water availability under future conditions and potential variations in the rate of sea-level rise could cause a project to move forward that is not viable under future climate change. To reduce future vulnerabilities, the committee urges the USACE to develop guidance on the use of quantitative approaches to considering climate change and variability in hydrologic analyses.

THE CASE FOR AN EVERGLADES RESTORATION SCIENCE PLAN

As the CERP pivots from planning to implementation and adaptive management during a time of rapid global change, it requires support from a science enterprise with the collective capacity and ability to contribute financial resources, skills and expertise, and facilities necessary to respond to critical knowledge impediments to restoration. Restoration progress has been inhibited by a lack of recent, centralized compilation of critical management questions and associated knowledge gaps that could guide CERP science funding decisions or serve as a basis for collaboration.

Therefore, the Everglades science enterprise should develop a science plan to advance and implement essential science actions that directly support restoration decision making. This effort will require intense multi-agency and stakeholder coordination. An Everglades Restoration Science Plan could serve as a central document that highlights and communicates priority science needs and management linkages to a broad audience of potential funders. The plan would guide the CERP program, other restoration initiatives, and individual funding agencies in their science investments. The plan should be updated regularly with the engagement of a diverse range of stakeholders to respond to changing needs. The Science Coordination Group is best positioned to lead an updated multi-agency assessment of priority science needs and gaps at a programmatic level and to develop this Everglades Restoration Science Plan.

COMMITTEE ON INDEPENDENT SCIENTIFIC REVIEW OF EVERGLADES RESTORATION PROGRESS

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