



# SOUTH FLORIDA ECOSYSTEM RESTORATION TASK FORCE

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## 2020 BIENNIAL REPORT



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Restoring America's Everglades

# South Florida Ecosystem Restoration Task Force: 2020 Biennial Report

## Report Purpose

The Biennial Report satisfies the requirements of the Water Resources Development Act of 1996 to report biennially on South Florida Ecosystem Restoration Task Force activities and progress made toward restoration. The reporting period for this edition is July 1, 2018 – June 30, 2020.

The Biennial Report is intended for four principal audiences:

- United States Congress
- Florida Legislature
- Seminole Tribe of Florida
- Miccosukee Tribe of Indians of Florida

The information included in this report will also be broadly shared with the State of Florida and federal agencies, local governments, and stakeholders interested in the restoration of the South Florida Ecosystem.

The Biennial Report is part of a suite of Everglades restoration documents prepared by the Office of Everglades Restoration Initiatives on behalf of the Task Force, all of which can be found at:

[EvergladesRestoration.gov](http://EvergladesRestoration.gov)

# EXECUTIVE SUMMARY

## Everglades Restoration and the South Florida Ecosystem Restoration Task Force

The South Florida Ecosystem is a unique natural treasure. An 18,000-square-mile region of subtropical uplands, wetlands, and coral reefs, the ecosystem extends from the Kissimmee Chain of Lakes south of Orlando to Florida Bay and the reefs southwest of the Florida Keys. A century of changes to the ecosystem, including an extensive network of canals and levees to drain land for agricultural and residential development, is being re-examined and reworked in order to restore this water-based system. Everglades restoration is key to both a healthy ecosystem and a vibrant economy. The environment and the economy are inextricably linked in south Florida where unique habitats and species, agricultural and tourism economies, and 8.7 million residents all depend upon plentiful, clean, fresh water.

Authorized by Congress in the Water Resources Development Act (WRDA) of 1996, the **South Florida Ecosystem Restoration Task Force (Task Force)** brings together the federal, state, tribal, and local agencies involved in restoring and protecting America's Everglades. The role of the intergovernmental Task Force is to facilitate the coordination of a myriad of conservation and restoration efforts being planned and implemented. It also provides a forum for the participating agencies to share information about their restoration projects, resolve conflicts, and report on progress. The Task Force's coordination and conflict resolution role is an essential key to our future successes in accomplishing our goals and in restoring and protecting America's Everglades.

The U.S. Department of the Interior's (DOI) Office of Everglades Restoration Initiatives (OERI) on behalf of the Task Force has developed a suite of documents to report on restoration goals and progress. The **Cross-Cut Budget** satisfies WRDA 1996 to report on coordinated budget requests for the Everglades ecosystem restoration efforts in south Florida with information provided by both federal and state agencies represented on the Task Force. This **Biennial Report** satisfies the requirements of the WRDA 1996 to report biennially on Task Force activities and progress made toward restoration. Details on individual restoration projects can be found within the **Integrated Financial Plan (IFP)**. The **Strategy** organizes the complex restoration effort by three strategic goals relating to water, habitats/species, and the built environment. Ecosystem health and response to restoration is described by the **System-wide Ecological Indicators** (a summary of which is found within Appendix A of this report).

These documents can be found at [EvergladesRestoration.gov](http://EvergladesRestoration.gov).

## Restoration Highlights

Restoration has moved forward in important ways over the past two years, and the following examples illustrate some of the most significant accomplishments achieved.

### Support for Restoration Remains Strong

Since 1993, the State of Florida and the federal government have made substantial investments of resources on restoration programs and projects for America's Everglades. The following are some examples of funding spent to date, including that for the Comprehensive Everglades Restoration Plan (CERP). Further information on restoration funding is provided in the Cross-Cut Budget and IFP.

- As of September 2020, the federal government has allocated \$1.7 billion in CERP funding, \$55 million in Critical Projects funding, \$389 million in Kissimmee River Restoration funding, over \$1.4 billion to rehabilitate Herbert Hoover Dike (HHD), and \$2.5 billion in Central and Southern Florida (C&SF) projects.
- During the reporting period, the federal government appropriated \$246 million for the CERP South Florida Ecosystem Restoration Program for fiscal year (FY) 2020 and there is currently \$257 million in the President's Budget for CERP for FY 2021.
- To date, the State of Florida has obligated \$2.6 billion in CERP funding, \$54 million in Critical

Projects funding, \$205 million in Kissimmee River Restoration funding, \$100 million to support the US Army Corps of Engineers (USACE) in its effort to rehabilitate the HHD, and \$2.1 billion in C&SF project funding. The State has also provided \$543 million for the Northern Everglades projects, \$1.7 billion for the Everglades Construction Project, \$130 million for construction of the Tamiami Trail Bridge, and \$205 million in Everglades Agricultural Area (EAA) Reservoir funding.

- The State of Florida signed into law \$298 million for FY 2018/19, including an additional \$50 million for the HHD and \$64 million for the EAA Reservoir. In FY 2019/2020 the State of Florida signed into law approximately \$443 million, including \$64 million for the EAA Reservoir and \$50 million for the Lake Okeechobee Watershed Restoration Project (LOWRP). An additional \$10 million was provided for the purpose of supporting the evaluation and implementation of innovative technologies and short-term solutions to combat or clean up harmful algal blooms and nutrient enrichment of Florida's fresh waterbodies, including lakes, rivers, estuaries, and canals.
- In 2016, the Florida Legislature passed the Legacy Florida Bill which provides a dedicated funding source for 10 years until 2026 for Everglades restoration. As written, it delivered approximately \$200 million in 2018 to restoration projects for the Everglades. In 2019, Executive Order 19-12 included a proposed \$2.5 billion investment over the next four years. This funding – for Everglades restoration and protection of water resources – is the highest level of funding for restoration in Florida's history.

## Comprehensive Everglades Restoration Plan (CERP)

The CERP, led by the USACE and the South Florida Water Management District (SFWMD), was authorized in WRDA 2000 to restore the quantity, quality, timing, and distribution of fresh water in the South Florida Ecosystem. The following highlights individual CERP projects currently underway.

### Restoring Natural Hydrology

The goal of the **Biscayne Bay Coastal Wetlands (BBCW) Project, Phase 1**, is to improve the ecology of Biscayne National Park (BNP) and the Biscayne Bay Aquatic Preserves, including the nearshore waters of Biscayne Bay and adjacent wetlands. The project will rehydrate coastal wetlands and reduce freshwater point source discharges by redistributing surface water flows through a spreader canal system. The USACE and the SFWMD have each constructed portions of this project. The SFWMD has constructed the final four culverts of the L-31E Flowway and the USACE is developing plans and specifications for the remaining features with contract awards scheduled for the end of FY 2020. Design of the Cutler Wetlands flow-way, which is also a phase 1 feature, is scheduled for completion in May 2021. SFWMD construction of this feature is anticipated to commence in late 2021 if funding from the State of Florida becomes available. Improvements in coastal vegetation and estuarine conditions downstream of the completed portions of the project are already being observed and documented, including decreased salinity and recruitment of freshwater tolerant sawgrass. Further restoration efforts will occur through the Biscayne Bay and Southeastern Everglades Ecosystem Restoration (BBSEER), which will start in the summer of 2020 (see Planning highlights below).

The goal of the **C-111 Spreader Canal Western Project** is to reduce seepage losses from Everglades National Park (ENP) and provide increased flows to Florida Bay through Taylor Slough. The SFWMD constructed the recommended plan, which includes an aboveground detention area, associated water management features and operational changes in south Miami-Dade County. The constructed features are already showing positive ecological benefits to the Taylor Slough area, including the Cape Sable seaside sparrow habitat and increased population in subpopulation D, by restoring more natural water conditions and flows. The USACE approved the SFWMD's deviation request to increase the operating range of the structure to improve hydroperiods in the Model Lands, and effects from the deviation are being monitored to determine the benefit to the ecosystem.

The **Picayune Strand Restoration Project** involves restoring flow in western Collier County across an area larger than the District of Columbia that was drained in the early 1960s in anticipation of extensive development that never materialized. The Miller Pump Station, construction and operational testing phase, was completed in May 2019; the pump station was transferred to the SFWMD in 2020. Analysis of the

effects on the water levels of adjacent private lands is complete. The removal of 65 miles of road and 26 miles of logging trams between Merritt and Faka Union canals is complete and design work and construction of flood protection features, road removal, and canal backfill continue. The Manatee Mitigation Feature designed to mitigate for impacts to an existing warm water habitat is complete and fully operational with manatees seen using the site as refuge during the cooler winter months of 2019. A construction contract for road removal was awarded in September 2019. Construction contract awards for the Southwest Protection Features (levee and conveyance features) are scheduled for the end of FY 2020.

The **Indian River Lagoon-South (IRL-S) Project** will help restore the St. Lucie Estuary and the southern portion of the Indian River Lagoon. Several components including the C-44 S-401 pump station and the Intake Canal have been completed. The reservoir pump station was completed in December 2018 and the 6,300-acre C-44 Stormwater Treatment Area (STA) is under construction by the SFWMD and is expected to be completed in 2020. The C-44 Reservoir, which will store up to 50,600 acre-feet of water, is under construction by the USACE and is expected to be completed in 2021. The USACE is continuing design of the C-23/24 components and expects to issue the construction contracts for the C-23/C-24 STA in late 2021 and for the north reservoir in 2022. The SFWMD is currently in the design phase for the C-23 to C-44 Interconnect Canal.

The **Caloosahatchee River (C-43) Western Basin Storage Reservoir Project** will provide 170,000 acre-feet of storage. Capturing excess flows from the basin during the wet season and then releasing the stored water to the estuary during the dry season will improve the timing and quantity of water delivered to the Caloosahatchee Estuary, aiding in meeting the minimum dry season flows. The project was authorized in the Water Resources Reform and Development Act (WRRDA 2014) and is being implemented at an accelerated pace by the SFWMD. During the reporting period, construction of the S-476 irrigation pump station was completed. Construction of the large S-470 pump station was awarded in 2018 and is expected to be completed in 2022. The civil works portion of the project, including construction of 19 miles of earthen embankment, 15 miles of perimeter canal, 14 water control structures, a pump station, 2 bridges, and recreational features, was initiated in June 2019.

### Restoring the Heart of the Everglades

The **Central Everglades Planning Project (CEPP)** was authorized in 2016. The goals of CEPP are to improve the quantity, timing, and distribution of water in the Northern Estuaries, central Everglades, Water Conservation Areas (WCAs), and ENP to restore habitats and ecological function in the natural system. The CEPP is a combination of several key CERP components and includes conveyance, decompartmentalization (the removal of levees and canals), and seepage management projects to deliver and distribute water to WCA-3B and ENP. The FY 2020 federal and state budgets increased significantly and resulted in acceleration of several CEPP features. The SFWMD has started construction on two crucial CEPP South components, the removal of Old Tamiami Trail, which is expected to be completed in 2022, and the S-333N water control structure, which is expected to be completed in late 2020. The USACE has been designing the L-67A Culverts and expects to start construction in late 2020.

The CERP **Everglades Agricultural Area (EAA) Project**, authorized in America's Water Infrastructure Act (AWIA) 2018, includes the A-2 Reservoir (known as the EAA Reservoir) and the A-2 STA to divert, store, and treat Lake Okeechobee and watershed regulatory releases. The SFWMD began design of the A-2 STA in June 2019 and started site preparation activities in April 2020. A Pre-Partnership Credit Agreement was executed in May 2020 allowing the SFWMD to initiate construction on the A-2 STA in June 2020. The USACE initiated design of the A-2 Reservoir and Pump Station in March 2020.

### Planning for Future Restoration Projects

During the reporting period, the USACE and the SFWMD continued to update the **Integrated Delivery Schedule (IDS)**. The IDS provides an overall strategy for project planning, design, and construction based upon ecosystem needs, benefits, costs, and available funding. The schedule helps restoration planners, stakeholders, and the public focus on priorities, opportunities, and challenges and provides a path forward to complete construction on previously authorized projects while outlining the next projects to undergo planning and design. The October 2019 IDS is currently being updated to reflect the significant increase in

the federal budget received in FY 2020 from the Administration and Congress. The IDS will continue to show the scheduling of the projects based on actual budgets received and notional future budgets. The IDS does not represent a commitment by the federal or state governments to include amounts reflected on the IDS in the federal or state budgets.

The planning for the **Loxahatchee River Watershed Restoration Project** was completed with submission and signing of a Chief's Report in April 2020. The project aims to restore and sustain the overall quantity, quality, timing, and distribution of freshwater to the federally designated "National Wild and Scenic" Northwest Fork of the Loxahatchee River.

The **Lake Okeechobee Watershed Restoration Project (LOWRP)** focuses on the major tributary systems that deliver water to Lake Okeechobee. The project would improve water levels in Lake Okeechobee; improve the quantity and timing of regulatory releases to the St. Lucie and Caloosahatchee estuaries; restore degraded habitat for fish and wildlife throughout the study area; increase the spatial extent and functionality of aquatic and wildlife habitat; and improve water supply for existing legal water users of Lake Okeechobee. A revised draft Project Implementation Report/Environmental Impact Statement (PIR/EIS) was posted for review in July 2019.

Planning efforts continued for the **Western Everglades Restoration Project (WERP)**. The overarching purpose of the WERP is to reestablish surface water sheetflow from the northern portion of the study area, across the Seminole Tribe of Florida Big Cypress Reservation and into the Big Cypress National Preserve (BCNP), while maintaining flood protection. The preliminary project objectives are to: (1) improve the quantity, quality, timing, and distribution of flows in the western Everglades; (2) re-establish sheetflow south of the West Feeder Canal on the Big Cypress Seminole Indian Reservation into BCNP; (3) restore water levels to reduce wildfires associated with altered hydrology; and (4) re-establish ecological connectivity. Although temporarily suspended from July 2019 to March 2020, the USACE reinitiated planning on this project in March 2020 due to strong support from the Seminole Tribe of Florida, the Miccosukee Tribe of Indians of Florida, the DOI, and BCNP.

The **Biscayne Bay and Southeastern Everglades Ecosystem Restoration (BBSEER)** planning study will begin just after this reporting period in July 2020. The study will include components of the C-111 Spreader Canal Eastern Project and Phase II of the BBCW Project. The purpose of the project is to improve the quantity, quality, timing, and distribution of freshwater to Biscayne Bay, including Card Sound, Barnes Sound, and BNP and adjacent wetlands; to improve the natural habitat quality in the Model Lands and Southern Glades; and to improve resiliency of these coastal habitats in light of sea level change.

## Foundation Projects

### A Partnership to Restore Flow through the River of Grass

The **Modified Water Deliveries to Everglades National Park (Mod Waters) project**, including a one-mile bridge and associated Tamiami Trail modifications completed in 2013, sets the stage for future CERP components and operating plans that have the potential to improve the quantity, quality, timing, and distribution of water deliveries to ENP. This project will support the recovery of wading bird populations, restoration of naturally occurring ridge and slough formations, restoration of fish and wildlife resources, and overall improvement of 63,000 acres of wetlands. The 8.5 Square Mile Area project provides mitigation for the increased water flow to Northeast Shark River Slough and ENP associated with the Mod Waters project. All features of this project are constructed and the Combined Operational Plan (COP) for the Mod Waters project is under development and scheduled to be completed in 2020.

Although not a foundation project, related elements of CEPP South currently moving forward include the removal of approximately 6 miles of Old Tamiami Trail and removal of the S-346. This will provide a net gain of wetland acreage, facilitate additional deliveries of water from WCA-3A directly to ENP, and aid in alleviating the high-water conditions currently being experienced in WCA-3A. In addition, construction of the S-333N to increase the conveyance capacity at the S-333 will be completed in 2020.

## The Return of a River

The **Kissimmee River Restoration Project** continues to shine as the keystone Everglades restoration project. After 20-plus years of large-scale construction, this project is nearing construction completion with positive interim ecological responses being observed in the restored Reach 1 and Reach 4 areas. In the river channel, reestablishment of flow eliminated organic deposits on the river bottom and undesirable floating and mat-forming plants have been replaced by native emergent species. Sandbars have reformed, creating new habitat for shorebirds and invertebrates. Dissolved oxygen, critical for the long-term survival of fish and other aquatic organisms, has increased up to six-fold, although challenges remain to avoid short-term declines in dissolved oxygen that can affect recovery of native sunfish populations dramatically. Largemouth bass and sunfishes now comprise 63 percent of the fish community; prior to restoration, they represented only 38 percent.

Wading bird foraging expectations are being met regularly when floodplain conditions are suitable and snail kites nested in a newly flooded section of the Kissimmee River floodplain in the 2018 wet season with good success rates. Long-legged wading bird populations, including white ibis, great egrets, snowy egrets and little blue herons, have increased significantly. Ducks have returned to the river, including American wigeons, northern pintails, northern shovelers, ring-necked ducks, and black-bellied whistling ducks.

The final two construction contracts are underway, including the final canal backfilling and completion of the S-69 weir at the downstream terminus of the project. These contracts will complete the backfill effort resulting in the rehydration of 25,000 acres of river floodplain. The USACE is scheduled to have all construction completed in 2021, resulting in the physical completion of this Foundation Project. After construction is completed, implementation of the Headwaters Revitalization Schedule is expected to provide the improved, longer hydroperiods needed for reestablishment of broadleaf marsh communities. The required five years of post-construction monitoring will commence upon full implementation of the Headwaters Revitalization Schedule, currently scheduled in 2021. Monitoring activities will evaluate the hydrologic integrity and ecological response expected to achieve full restoration.

## Water Quality

### Continuing to Invest in Water Quality Restoration

During the reporting period, the State of Florida made significant progress implementing the **Restoration Strategies** water quality plan, building on its existing multi-billion-dollar investment in water quality improvements in the Everglades. The Restoration Strategies plan includes more than 6,500 acres of new STAs and 110,000 acre-feet of additional water storage through construction of Flow Equalization Basins (FEBs). To date, 7 projects are complete, 6 others are ongoing, and 52 of the 74 consent order milestones have been achieved, 46 of them ahead of their deadlines. The Restoration Strategies project works in conjunction with existing STAs to achieve compliance with State of Florida water quality standards. All projects are scheduled to be completed by December 2025.

The state is responsible for meeting state water quality standards and court orders. If it is determined that incremental water quality improvements above these levels are deemed essential to Everglades restoration, the Corps may participate. In addition to its improvements to the quantity, timing, and distribution of flows previously mentioned, the **CERP Indian River Lagoon (IRL) South Project** will also generate water quality improvements to the St. Lucie Estuary and the southern IRL. After construction is completed, the project will capture local runoff from the C-44 basin, reducing average annual total nutrient loads and improving salinity in the St. Lucie Estuary and the southern portion of the IRL. Current efforts are focused on completing the construction of the C-44 Reservoir and STA and the design effort for the C-23/24 reservoirs and STA. The SFWMD has completed construction of the S-401 pump station that will serve the C-44 Reservoir and the S-404 STA discharge structure. The SFWMD has initiated hydration of 5 of the 6 STA cells, and expects to complete construction on the 6,300-acre STA in late 2020.

## Habitat Protection and Restoration

### Restoring Wetlands

The U.S. Department of Agriculture (USDA) supports the restoration of the Everglades by providing financial and technical assistance to private landowners and tribes. The **Agricultural Conservation Easement Program (ACEP)**, implemented through the USDA's Natural Resources Conservation Service, provides agricultural and wetland easements to landowners.

During the reporting period, the USDA invested over \$42 million in ACEP funds for the acquisition and restoration of 21,500 acres of land in Florida. Over 75% of this investment was within the Northern Everglades Initiative area. For 2018-20, Florida once again received one of the largest ACEP funding allocations in the nation.

### Estuary and Coral Reef Protection

The National Oceanic and Atmospheric Administration (NOAA) and the State of Florida oversee the conservation, management and restoration of the Florida Reef Tract, which represents the downstream extent of the South Florida Ecosystem. In addition to traditional conservation activities such as developing management plans, monitoring, and conducting debris cleanups, NOAA and numerous partners have recently engaged in an unprecedented coral disease response and initiated a bold new coral restoration initiative. While these activities are ongoing, parallel efforts to ensure the presence of environmental conditions required for coral survival, such as local water quality improvement efforts through the Water Quality Protection Program and Southeast Florida Coral Reef Initiative, and regional water quality enhancements through the CERP, are critical to ensure the long-term survival and recovery of these ecologically and economically important natural resources.

## Invasive Exotic Species

### Combatting Invasive Exotic Species

The South Florida Ecosystem is one of the most highly vulnerable regions to the threat of invasive exotic species (IES) in the entire United States. The Task Force has developed an **Invasive Exotic Species Strategic Action Framework (Framework)** that is organized along the four phases of invasion/response: Prevention, Early Detection and Rapid Response (EDRR), Containment, and Long-term Management/Resource Protection. In 2019, OERI initiated an update of the 2015 Framework with Task Force members and partners. The 2020 Framework will be available online at [EvergladesRestoration.gov](http://EvergladesRestoration.gov). Although continued progress is being made in areas such as EDRR, adequate and consistent funding year-to-year is needed in order to effectively combat invasive exotic species and minimize their impact on the ecosystem. Highlights of progress made over the past two years are listed below.

**Prevention:** The first opportunity to combat an invasion is to prevent it from starting. Prevention strategies include regulation, border protection, and public engagement. In 2019, the Florida Fish and Wildlife Conservation Commission (FWC) approved rule changes to help close a loophole in federal law regarding interstate transport of several nonnative species. In 2017, the D.C. Circuit Court ruled that the Lacey Act does not prohibit transport of injurious wildlife between states within the continental United States. In response to the court ruling, the FWC added 13 species to the state's Prohibited Species list in 2019 that would pose significant risk if introduced in Florida. Of these, three anacondas are of particular concern for the Everglades.

**Early Detection and Rapid Response (EDRR):** If prevention is not possible or the opportunity to prevent an invasion is missed, the next approach is eradication through EDRR. Eradication requires that the species be detected early in the invasion process, that the risk it poses is assessed quickly, and that sufficient tools and resources are available to respond rapidly to the invasion. The need for an EDRR decision support tool

for invasive animal species was identified in the Task Force's 2015 IES Framework. The decision support tool, subsequently developed through the U.S. Geological Survey (USGS) Priority Ecosystem Studies program, provides a standardized and transparent process for ranking those nonnative animal species that warrant a rapid response after their detection within the ecosystem. This tool was adapted by the FWC for statewide use during the reporting period and will continue to be updated and enhanced. More than a dozen species have been run through the screening tool to date.

**Containment:** Once IES populations increase and become distributed over a large area, eradication is far less feasible. At this point, the management strategy shifts to containment, with the purpose of preventing the spread to new areas. The Argentine black and white tegu is an invasive reptile with an established breeding population in southern Miami-Dade County. Their high reproductive capacity, lack of potential predators, and adaptability make this tegu a threat to Florida's wildlife and environment. Despite increases in management, research, and coordination efforts, the population in southern Miami-Dade County continues to expand and has reached the ENP boundary. At least 8 tegus were trapped just inside the park in early 2020 prompting federal and state agencies to substantially increase the number of traps near the park boundary in efforts to keep the reproducing population outside the park. In July 2020, the FWC added tegus and green iguanas to their list of regulated species that limits possession to educational or research purposes. Pet owners possessing tegus prior to July 1, 2020 may obtain a permit to lawfully possess that animal for the remainder of its life.

**Resource Protection and Long-term Maintenance:** Once invasive exotic species are widespread and abundant, efforts shift to population suppression to lowest feasible levels (i.e., maintenance control) and removal at priority areas in order to mitigate the impacts of the invader on natural resources, economic interests, and human health. A limiting factor in achieving maintenance control of invasive exotic plant species is consistent, long-term funding. Gains made in one year can be lost if funding levels decrease for the necessary long-term management of invasive plants. This challenge will be further complicated if glyphosate-based herbicides are taken out of the long-term management toolbox for invasive exotic plants.

The CERP Biological Control Implementation Project continues to rear and release approved biological control agents for several priority invasive plant species in south Florida. During the reporting period, the USDA's Agricultural Research Service (ARS), in collaboration with USACE and SFWMD, strategically released agents for the suppression of Old World climbing fern, Brazilian pepper, and water hyacinth.

The Burmese python is an established threat to native wildlife in the Everglades. During the reporting period, removal efforts expanded extensively with the SFWMD and FWC increasing the total number of state removal contractors to 100 and ENP expanding its program from 130 to 250 removal agents. These programs now cover ENP, Big Cypress National Preserve, and most state-managed lands. Other efforts underway include development of a statewide python management plan, landscape level python telemetry tracking, and USGS eDNA surveys to monitor possible range expansions of the Burmese python, particularly near Loxahatchee NWR.

Lionfish, a popular aquarium fish native to the Indo-Pacific, can now be found from Venezuela to North Carolina. Lionfish have few predators and represent a threat to native fish species, many of which have economic importance (sportfishing) or ecological importance for the health of Florida's Coral Reef. NPS' long-term management efforts for lionfish, having been sustained at appreciable levels for the past 10 years, have helped identify areas frequented by lionfish for targeted removal efforts and helped develop best available control tools. During the reporting period, 988 lionfish were removed from BNP. FWC has also engaged the public with lionfish events and outreach meant to inform the public of ways to help slow down the lionfish invasion.

## Science

### Studying Impacts of Hurricane Irma

Following Hurricane Irma, which occurred September 10, 2017, a special issue of *Estuaries and Coasts* (July 2020), published scientific papers assessing impacts of, and recovery, from, Hurricanes Irma, Harvey, and Maria. Thirteen of the 25 papers were related to Irma's impacts on south Florida. While hurricanes are a natural feature of south Florida and a normal part of ecological succession, human impacts on the ecosystem may be affecting the way the Everglades responds to natural disturbances. Monitoring and research on Hurricane Irma impacts will continue for several years into the future.

Water managers and scientists at USACE, working in concert with those from partner agencies and tribes, continue to assimilate the latest scientific data from across the South Florida Ecosystem to inform deliberate and transparent decisions. Interagency teams meet and report on-the-ground ecological conditions of Lake Okeechobee on a weekly and monthly basis through calls and online reporting (<http://w3.saj.usace.army.mil/h2o/reports/StatusDaily.htm> and <https://www.sfwmd.gov/science-data/operational-planning>). Annual summaries of lake conditions are published by the SFWMD in a scientific, peer reviewed report called the South Florida Environmental Report (<https://www.sfwmd.gov/science-data/scientific-publications-sfer>). The following describes some of the recent lake conditions by Water Year (WY), which are from May 1 to April 30.

Overall, water quality conditions improved in Lake Okeechobee from WY 2018, when it was impacted by Hurricane Irma, which passed over Lake Okeechobee in early September 2017. As published in the 2020 SFER, surface water inflow to Lake Okeechobee was 1.99 million acre-feet in WY 2019, nearly a 42% decrease from WY 2018 inflows of 3.42 million acre-feet. Total phosphorus (TP) loads to the lake from atmospheric deposition and tributaries totaled 442 tons in WY 2019, less than half the WY 2018 TP load (1,081 tons). This year's load reduction can generally be attributed to drier conditions and decreased flow volumes.

Low lake stages had mixed effects in WY 2019. Beds of newly sprouted eelgrass sprouted across areas were wiped clean by Hurricane Irma in 2017. Lower lake stages promoted reduced nutrient levels and clearer water in nearshore zones towards the end of the WY, aiding in vegetation recovery. Wading birds and Everglade snail kites had the lowest nest totals since WY 2009 (1,575 nests and 0, respectively) while wading bird foraging numbers were the highest recorded (15,954 birds in late April 2019) since surveys began in WY 2010.

Hurricane Irma caused dramatic increases in suspended solids and uprooted emergent vegetation. Despite the time elapsed since Hurricane Irma, lake water quality and aquatic habitat continued degrading into WY 2019. Submerged aquatic vegetation (SAV) recovery was not observed until spring 2019. In WY 2019 (May 1, 2018 through April 30, 2019), the total areal coverage of SAV reached approximately 5,200 acres, the lowest in 12 years. Additional operational flexibility in the Lake Okeechobee Regulation Schedule facilitated a 4-fold increase in acres of SAV in Lake Okeechobee during the summer growing season in 2019 (WY 2020).

## Conclusion

**Project Completions and Construction Underway to Improve Water Quantity, Quality, Timing, and Distribution:** Restoration efforts for the Everglades continued during the reporting period on many fronts. The final construction contracts for the Kissimmee River Restoration Project are nearing completion. Construction continues on two major reservoir projects, the C-43 and the C-44 reservoirs. When complete in the next 2-4 years, these two reservoirs will provide much needed relief to the Caloosahatchee and St. Lucie estuaries. In the central Everglades, design and construction continued for CEPP South and EAA features. In addition, all construction contracts were completed for the Mod Waters Project. This, coupled with the completion of the C-111 South Dade Project, will allow the implementation of a new operational

plan for bringing more water into the eastern portion of ENP. The new COP for the Mod Waters and C-111 projects, to be completed in August 2020, was described in the USACE's 2019 Draft EIS, which incorporated lessons learned during a four-year incremental testing program. The new Tamiami Trail Flow Formula to be utilized within the COP is key to optimizing water management in the central Everglades (WCA-3), ENP, and the South Dade agricultural areas. Construction also continued on the BBCW Phase 1 project to expand the rehydration of coastal wetlands bordering Biscayne Bay. The State of Florida continued its progress on the construction of the Restoration Strategies Program to improve the quality of water entering the Everglades.

**New Project Construction on the Horizon:** Major planning efforts for the Lake Okeechobee Watershed Restoration Project and the Loxahatchee River Watershed Restoration Project were ongoing in 2020. These projects will continue progress towards providing more storage north of the lake and restoring more natural flows to Florida's first federally designated "wild and scenic river" while also increasing available water supply in that area.

**Enhancing our Collective Ability to Combat Invasive Exotic Species:** Efforts continued during this period in the battle against the invasion and expansion of exotic species in south Florida. New programs were launched and/or expanded to deal with the Burmese python and Argentine black and white tegu that increased the capture and removal of these species, while research, tool development, educational programs, and public outreach continued to assist in the fight against all invasive exotic plant and animal species.

**Using Science and Monitoring to Improve Restoration Efforts:** The System-wide Ecological Indicators and the System Status Report continue to show ecosystem problems and challenges in key areas, many of which were compounded by the weather extremes experienced. These problems and challenges further underline the need for ecosystem restoration. Continued monitoring and assessments as projects are implemented will inform the overall restoration effort of progress made, areas of concern, and improvements in ecosystem health.

The Everglades has struggled to maintain ecosystem functions that support south Florida's tourism, recreation, and economy due to anthropogenic inputs, flood control and water supply needs for an ever expanding population base, and increasing frequency of extreme weather events that exacerbate impacts to the natural system. Essential ecological functions have been degraded, leading to often unsuitable habitats for native plants and animals. The South Florida Ecosystem Restoration program will help to correct these issues and the results achieved by early individual projects such as Picayune Strand, BBCW Phase 1, and the bridging of Tamiami Trail are encouraging. Within regions of the Everglades, research and restoration projects have already improved the management of hydrologic flows and increased water storage, which are key to achieving the restoration goals of improving wetland hydroperiods and flows of freshwater into coastal areas. The 2019 System Status Report provides a comprehensive report on the health of the everglades. Continued project and program implementation will build on these successful efforts for restoration of America's Everglades.

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# INTRODUCTION

The South Florida Ecosystem, an area twice the size of New Jersey, is a multifaceted mixture of dense forests and open prairies, sunny croplands and shady swamps, sprawling seagrass beds and complex coral reefs, rural expanses and dynamic cities. It is also one of the primary sources of water for 8.7 million residents. Historically, water flowed slowly from the Kissimmee River to Florida Bay across the ecosystem's extremely flat landscape forming what became known as the "River of Grass." This natural functioning system began to be altered over a century ago in attempts to make the ecosystem more hospitable to agriculture and development.

The quality of life in south Florida and the region's economy depend on the health and vitality of the natural environment. South Florida's environment provides unique recreational opportunities that draw visitors from around the globe, from freshwater fishing in the north to snorkeling in the southern-most reaches of Florida's Coral Reef. Fertile soils support the region's agricultural industry. The Seminole Tribe of Florida and the Miccosukee Tribe of Indians of Florida live in the Everglades and their culture and way of life depend on the health of this ecosystem.

A healthy ecosystem depends on reversing the unintended consequences of past changes to the region's waters and habitats. Restoring the Everglades and protecting south Florida's natural resources cannot be achieved by any single organization but depends upon a strategically coordinated set of federal, state, local, and tribal initiatives, funding, and partnerships. These restoration programs and projects require a long-term process for addressing key technical, management, and policy issues. In 1996, the intergovernmental South Florida Ecosystem Restoration Task Force (Task Force) was created by Congress to provide this long-term strategic coordination and to facilitate the incorporation of new information and opportunities over the multi-decadal restoration initiative.

The Water Resources Development Act (WRDA) of 1996 requires the Task Force to provide a biennial update on restoration progress. This document reports on the major hydrological restoration projects, water quality improvement projects, land acquisition efforts, habitat conservation programs, invasive exotic species efforts, water supply planning, and flood protection projects taking place within the South Florida Ecosystem. These projects are working in concert to reverse the damage the current water management system has inadvertently caused the Everglades, while continuing to serve the millions of people who reside within and visit the region. The Biennial Report also provides updates on the activities of the South Florida Ecosystem Restoration Task Force, Working Group, and Science Coordination Group.

This Biennial Report includes a summary of South Florida Ecosystem restoration activities for the current two-year reporting period (July 1, 2018 – June 30, 2020). The Task Force's **2020 Integrated Financial Plan** contains detailed information on each project described within the Biennial Report. In addition, the Task Force issues a biennial **System-wide Ecological Indicators Report**. The indicator report tracks ecosystem health and response to restoration through a suite of 11 system-wide ecological indicators. A summary of the indicator report is provided in Appendix A. The **Cross-Cut Budget** satisfies the WRDA 1996 requirement to report on coordinated budget requests for Everglades ecosystem restoration efforts in south Florida; information is provided by both federal and state agencies represented on the Task Force. However, it does not represent a commitment by the federal or state government to include amounts reflected on the IDS in the federal or state budget. All these documents can be found at [EvergladesRestoration.gov](http://EvergladesRestoration.gov).

# COMPREHENSIVE EVERGLADES RESTORATION PLAN (CERP)

The CERP is the single largest restoration program underway in the South Florida Ecosystem. The CERP is implemented by a federal-state partnership to restore, protect, and preserve the region's water resources by addressing the quantity, quality, timing, and distribution of water. Implementing projects that capture, store, clean, and redistribute water will restore natural water flow, enhance and protect habitats, and improve our ability to retain and utilize much needed fresh water within the ecosystem, instead of having to drain this precious resource to the Atlantic Ocean and Gulf of Mexico.

The WRDA 2000 approved the CERP as a framework for modifications and operational changes to the Central and Southern Florida (C&SF) Project that are needed to restore, preserve, and protect the South Florida Ecosystem while providing for other water related needs of the region, including water supply and flood protection. Subsequent water resource development acts authorized specific projects within CERP. These subsequent authorizations are often referred to as "Generations" with Generation 1 projects having been authorized in WRDA 2007 and Generation 2 projects in the Water Resources Reform and Development Act (WRRDA) of 2014. The WRDA 2016 (Water Resources Infrastructure Improvements for Nation (WIIN) Act) authorized the Central Everglades Planning Project (CEPP). The CERP EAA Reservoir Project was authorized in America's Water Infrastructure Act (AWIA) of 2018. The US Army Corps of Engineers (USACE), the South Florida Water Management District (SFWMD), and other partners are working together to implement the CERP.

## GENERATION 1 PROJECTS

**Picayune Strand Restoration Project:** This CERP project involves restoring flow across an area larger than the District of Columbia in western Collier County that was drained in the early 1960s in anticipation of development that never materialized. It will restore over 55,000 acres by removing barriers, plugging 42 miles of canals, and degrading 285 miles of roadways and 62 miles of logging trams. The project features will aid in rehydration of the wetlands and restoration of the natural flow of water in the region while maintaining flood protection for neighboring communities. Construction of the project is approximately 80% complete. The Miller Pump Station, construction and operational testing phase, was completed in May 2019; the pump station was transferred to the SFWMD in 2020. Removal of 65 miles of road and 26 miles of logging trams between Merritt and Faka Union Canals is complete and design work and construction of flood protection features, road removal, and canal backfill continue. A construction contract for road removal was awarded in September 2019. Construction contract awards for the Southwest Protection Features (levee and conveyance features) are scheduled for the end of FY 2020.

Ecological benefits of this project are already being seen. The Manatee Mitigation Feature designed to mitigate for impacts to an existing warm water habitat was completed in 2016. During the winter months of the reporting period, manatees were seen taking advantage of this warm water refuge. Early restoration benefits also include the reemergence of foraging wading birds and native flora that have been absent in the area for decades.

**Indian River Lagoon-South Project (IRL-S) Project:** This CERP project includes the C-44 Reservoir and STA, the C-23/24 and C-25 reservoirs and stormwater treatment areas (STAs), the acquisition and implementation of 90,000 acres of natural storage areas, the removal of more than 7 million cubic yards of muck from the IRL, North Fork St. Lucie River flood plain restoration, and the placement of artificial habitat (reef balls, etc.) in portions of the lower St. Lucie Estuary. Current efforts are focused on completing the construction of the C-44 Reservoir and STA (RSTA) and the design effort for the C-23/24 reservoirs and STA. The C-44 Reservoir pump station was completed in December 2018 and the STA is scheduled for completion in late 2020. The USACE awarded the construction contract for the C-44 Reservoir, capable of storing up to 50,600 acre-feet of water, and construction is scheduled to be completed in 2021. This will be followed by up to one year of operational testing and monitoring for all the completed features of the C-44 RSTA. The USACE initiated pre-design work for the C-23/24 North Reservoir in 2018 and the C-23/24 STA in 2019, including hydrographic, topographic, LiDAR, cultural resources, and geotechnical surveys in the lands that the SFWMD has acquired. The design for these components will continue through 2021 and is scheduled for construction in 2022. The SFWMD initiated design for the C-23 to C-44 Interconnect (southern diversion) in 2019, with land acquisition, survey, and geotechnical work efforts currently underway. In 2022, design is expected to be completed and construction will begin.

## GENERATION 2 PROJECTS

**Broward County Water Preserve Areas Project:** This project consists of three components, the C-11 Impoundment, the C-9 Impoundment, and the Seepage Management Area, which work together to form a regional project that manages seepage loss, captures stormwater, and conveys water for other purposes. The two impoundments will provide over 10,800 acre-feet of storage for stormwater runoff in western Broward County. The Mitigation Area A Berm was completed in November 2019. Design of the C-11 Impoundment is currently underway with a construction contract award scheduled for September 2022. The project will contribute to the environmental restoration of south Florida by diverting stormwater that is currently sent to the WCA-3 into the aboveground reservoirs, reducing phosphorus loading in the Everglades. The water will then be released to maintain the C-11 canal levels. The project will also support hydropattern restoration by keeping clean Everglades water in the natural system via seepage control. The combined hydrologic and reduced phosphorus benefit will reduce the expansion of cattail and reduce the increase in nutrient enriched soils. This provides benefit to periphyton, prey fish, wading birds, and other ridge and slough related species.

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**Biscayne Bay Coastal Wetlands Project (BBCW), Phase 1:** The goal of this CERP project is to improve the ecology of Biscayne National Park (BNP) and Biscayne Bay Aquatic Preserves (BBAP) by rehydrating coastal wetlands and reducing direct freshwater flows by redistributing surface water flows through a spreader canal system. Phase 1 includes construction of three components (Deering Estate, L-31E Culverts, and Cutler Wetlands) to redistribute the flow of surface water into Biscayne Bay. In FY 2020, the SFWMD completed construction of the L-31E Flowway culverts. The USACE is scheduled to award two construction contracts for the remaining L-31E Flowway features in FY 2020. The project will rehydrate 190 acres of freshwater wetlands, increase hydroperiods from approximately 70 to 200 days per year, improve oyster bars, submerged aquatic vegetation (SAV), wetland vegetation, and associated biota, increase abundance of fish and abundance and diversity of seagrasses, improve habitat for alligators and juvenile crocodiles, and produce high-functioning grassy wetlands that will serve as critical habitat to prey fish and wading birds.

**C-111 Spreader Canal Western Project:** The goal of this project is to reduce seepage losses from Everglades National Park (ENP) and provide increased flows to Florida Bay through Taylor Slough. The project includes an aboveground detention area, two pump stations, canal plugging, culverts, and operational changes in south Miami-Dade County. To jump start the recovery of the Taylor Slough area, most of the project features were constructed by the SFWMD in advance of authorization in WRRDA 2014. By restoring more natural water conditions the constructed features are already showing positive ecological benefits to the Taylor Slough area, including an increase to subpopulation D of the Cape Sable seaside sparrow habitat. The USACE approved the SFWMD's deviation request to increase the operating range of the structure to improve hydroperiods in the Model Lands and effects from the deviation are being monitored to determine the benefit to the ecosystem.

**Caloosahatchee River (C-43) West Basin Storage Reservoir:** Construction of this 10,700-acre reservoir is underway and is scheduled to be completed in 2024, followed by a 2-year operational testing and monitoring period. When completed, this reservoir will provide 170,000 acre-feet of storage. Capturing excess flows from the basin during the wet season and then releasing the stored water to the estuary during the dry season will improve the timing and quantity of water delivered to the Caloosahatchee Estuary, aiding in meeting the minimum dry season flows. The S-470 Intake Pump Station contract was awarded in 2018. In 2019, the final contract for the Embankment and Civil Works was awarded and construction of the S-476 Irrigation Pumping Station was completed.

## CENTRAL EVERGLADES EFFORTS

Authorized in the WRDA 2016, the goals of the CEPP are to improve the quantity, quality, timing, and distribution of water in the Northern Estuaries, Water Conservation Areas (WCAs), and ENP in order to restore habitats and ecological function in the natural system. The CEPP is a combination of several conveyance, and decompartmentalization (the removal of levees and canals) projects in the heart of the Everglades. These projects are grouped into CEPP South, CEPP North, and CEPP New Water. CEPP South focuses on providing additional outlet structures to move more water south and CEPP North focuses on inflow facilities needed to restore northern WCA-3A and move additional water south to the Everglades. CEPP New Water focuses on getting new water south with canal conveyance improvements and construction of a seepage barrier.

The CEPP Validation Report for the southern features was completed in May 2019 and the Project Partnership Agreement will be executed in July 2020 by the USACE and SFWMD. The validation report focused on removing water flow barriers in the southern portion of the project's footprint, which will allow flexibility to flow more water south. SFWMD construction of the S-333N (1,150 cfs spillway structure) began in October 2018 and will be completed in late 2020. SFWMD removal of Old Tamiami Trail began in February 2020 and will be complete by 2022. The USACE anticipates mobilization and onset of construction of Contract #1 (S-631, S-632, S-633, L-67A Spoil Removal, and L-67C Levee Gap) in 2020. The USACE design is underway for additional CEPP South features including the S-355W spillway structure in the L-

29 Canal levee and the 1,000 cfs S-356E pump station that will replace the existing 500 cfs S-356 pump station.

Authorized in America's Water Infrastructure Act (AWIA) of 2018, the SFWMD's Section 203 entitled "CEPP Post Authorization Change Report (PACR)" provided additional water storage and treatment including a 240,000 ac-ft storage reservoir, known as the EAA or A-2 Reservoir and a 6,500 acre STA. The SFWMD initiated design of the A-2 STA in June 2019 and initiated site preparation in April 2020 while the USACE initiated design of the A-2 Reservoir and Pump Station in March 2020. A Pre-Partnership Credit Agreement was executed in May 2020 allowing the SFWMD to initiate construction of the A-2 STA in June 2020.

## CERP PLANNING EFFORTS

**Loxahatchee River Watershed Restoration Project (LRWRP):** This CERP project will restore and sustain the overall quantity, quality, timing, and distribution of fresh water to the federally designated "National Wild and Scenic" Northwest Fork of the Loxahatchee River. This project also seeks to restore, sustain, and reconnect the area's wetlands that form the historic headwaters for the river and northeastern Everglades. The Project Implementation Report (PIR)-Environmental Impact Statement (EIS) was completed in 2020 with a Chief of Engineers report signed in April 2020. The Recommended Plan delivers 98% of the wet season restoration flow target and 91% of the dry season restoration flow target for the Northwest Fork of the Loxahatchee River. The Recommended Plan also improves wetland hydrology in the Pal-Mar natural area complex and restores 17,000 acres of various types of agricultural land that are part of the historical Greater Everglades. An additional 10,000 acres of natural areas are improved in the J.W. Corbett Wildlife Management Area, Loxahatchee Slough, and Kitching Creek. These habitats collectively include a unique mix of ridge and slough, and mesic and wet flatwoods, wet prairie, cypress floodplain, cypress strand, dome swamps, depression marsh, mesic and hydric hammock plant communities. The restoration actions also improve connectivity for over 78,000 acres of natural areas and restored wetlands that benefit many species of flora and fauna, including endangered and recreationally important species.

**Western Everglades Restoration Project (WERP):** This study is aimed at re-establishing ecological connectivity of wetland and upland habitats in the western Everglades with restored freshwater flow paths, volumes and timing, seasonal hydroperiods, and historic distributions of sheetflow. The project will result in restoration of and sustainability of native flora and fauna, reduction in wildfires and promotion of system-wide resilience considering future change, such as sea level rise and climate change. The study began in 2016, and working with stakeholders and state and federal agencies, the project team has identified a plan that will meet the objectives. The study was suspended from July 2019 to March 2020 due to real estate, acceptability, and cost effectiveness concerns. USACE reinitiated planning efforts in March 2020

**Lake Okeechobee Watershed Restoration Project (LOWRP):** This CERP study area covers approximately 1,450,000 acres, primarily located north of Lake Okeechobee, and includes Lake Okeechobee and the Caloosahatchee and St. Lucie estuaries. Through addition of shallow above ground storage, Aquifer Storage and Recovery (ASR) wells, and wetland restoration features, the LOWRP Recommended Plan improves operational flexibility in Lake Okeechobee to address variability in wet and dry environmental conditions. The infrastructure and operational flexibility provided would result in improved water levels in Lake Okeechobee; improved quantity and timing of regulatory releases to the St. Lucie and Caloosahatchee estuaries; increased spatial extent and functionality of aquatic and wildlife habitat; and improved water supply for existing legal water users of Lake Okeechobee. The Revised Draft Integrated PIR/EIS for LOWRP was published in the Federal Register in July 2019. The Florida Legislature provided \$50 million in FY 2020 to begin implementation of LOWRP components designed to achieve the greatest reductions in flood control releases to the Caloosahatchee and St. Lucie estuaries. The SFWMD has begun siting evaluations for ASR well cluster locations identified in the Integrated PIR/EIS. Construction of exploratory boreholes is anticipated to begin in late 2020.

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**Biscayne Bay and Southeastern Everglades Ecosystem Restoration (BBSEER):** This CERP planning study will include components of C-111 Spreader Canal Eastern and BBCW Phase II. The purpose of the project is to improve the quantity, quality, timing, and distribution of freshwater to Biscayne Bay, including Card Sound, Barnes Sound, and BNP; to improve the natural habitat quality in the Model Lands and Southern Glades; and to improve resiliency of these coastal habitats in light of sea level change. An objective of this project is to restore freshwater and estuarine habitat, including estuarine nursery habitat along the shoreline. The study will begin in July 2020 and the final product will be an Integrated PIR and EIS, which will require authorization by Congress.

## OTHER CERP AND RELATED PROJECTS

**Water Conservation Area 3 Decompartmentalization and Sheetflow Enhancement Physical Model (DPM):** This CERP project is a design effort that provides for the temporary installation and testing of water management features to address scientific, water flow, and water management uncertainties prior to the decompartmentalization of WCA-3. Construction of the test features was completed in 2012 and operational testing has been underway to determine the effects of point-source velocity on vegetation restoration, mechanisms to restore slough hydrology, and alternative levels of canal plugging to reconnect WCA-3A with WCA-3B. Results of the testing indicate an ecological impact from unplugged canals, a need to integrate energy/water quality dispersers downstream of a culvert, and the feasibility of restoring historic slough patterns. More details can be found in the annual South Florida Environmental Reports from 2016 to 2020.

**Melaleuca Eradication and Other Exotic Plants (Biological Control Implementation Project):** This project is dedicated to the implementation of biological control agents to address the spread of nonnative weeds throughout the CERP area. The project included the construction of a mass rearing annex to the existing US Department of Agriculture-Agricultural Research Service (USDA-ARS) biological control facility in Davie, Florida, to rear, release, establish, and monitor approved biological control agents for melaleuca and other nonnative weeds in the CERP area. USDA-ARS, in close coordination with the SFWMD and the USACE, has begun the operational phase of the project and, to date, has released more than six million insects and mites on three weed species. Releases are continuing along with extensive field monitoring and evaluation of the biological control agents. Current rearing and release efforts are targeting Old World climbing fern, Brazilian pepper, and water hyacinth.

**Integrated Biscayne Bay Ecological Assessment and Monitoring (IBBEAM):** The SFWMD, Miami-Dade Department of Environmental Resource Management (DERM), the National Park Service (NPS), and the National Oceanic and Atmospheric Administration (NOAA) are currently monitoring and assessing effects of CERP and BBCW implementation in western nearshore Biscayne Bay between Shoal Point and Turkey Point. The NPS and the NOAA monitor and record (every 15 minutes) salinity, temperature, conductivity, and water depth along this shoreline. The SFWMD has additional recording stations that monitor surface and ground water in the upstream wetlands. The NOAA produces salinity indices (Mesohaline Frequency, Mesohaline Duration, Hypersalinity, and several others) from the recorded data. The NOAA and the NPS, with the University of Miami, conduct biological sampling in the area that includes SAV, mangrove fish, and epifauna. Collectively, these biological species inform scientists about the health of bay's habitat and a food chain that extends to commercial and recreational fishes. During the reporting period, Habitat Suitability Models (HSMs) were produced for the key SAV, mangrove fish, and epifauna species. Classification of species based on salinity at the time and place where found and a multispecies index based on these classifications will be used, along with the salinity indices, to help detect progress towards a freshwater inflow regime that will support estuarine fauna in the nearshore bay, an objective of CERP and the BBCW. The index based on multispecies salinity-habitat classification is being applied initially to the Deering Estate nearshore area, the first fully established site of BBCW of flow modifications,

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to identify changes in species composition that might suggest a substantive change in nearshore salinity. The salinity indices based on recorded data already are being applied throughout the monitored area, where they indicate that mesohaline habitat now exists only ephemerally between the Princeton and Mowry canals.

# NON-CERP AND FOUNDATION PROJECTS

The planning process for CERP assumed that a set of previously authorized projects would be completed and thus serve as a foundation for CERP implementation. Foundation Projects seek to provide improvements to the quantity, quality, timing, and distribution of water through the construction of water storage and management features and the removal of impediments to surface water flow. Additional non-CERP hydrological restoration projects are also discussed below.

**C-111 South Dade Project:** This Foundation Project is intended to restore the wetland sloughs and prairies along the eastern boundary of ENP and improve hydrologic conditions in Taylor Slough and other adjoining areas of the Park. The project sends more fresh water through Taylor Slough towards Florida Bay, thus improving portions of the bay's health by reducing nearshore salinity. At the same time, project features maintain flood protection for development and agricultural interests located east of the project. Construction contracts completed during the reporting period include Contract 8 (Northern Detention Area and modifications to South Detention Area) in March 2019 and Contract 9 (plugging of L-31W Canal, rebuilding L-31W Levee and integrated weir, and monitoring stations) in March 2020.

Land acquisition is expected to be completed in 2021. In addition to the ongoing incremental field tests, the final operating plan for this project was developed as part of the public process for the operational study called the Combined Operational Plan (COP) for the Modified Water Deliveries to Everglades National Park (Mod Waters) and C-111 projects. The COP is expected to be approved by the USACE in August 2020. In the future, additional flows to both Northeast Shark River Slough and Taylor Slough are anticipated when the COP is implemented.

**Florida Bay Initiative:** In 2017, the SFWMD finished implementing all recommended projects except for two: 1) a curtain wall in South Dade requires additional planning and public engagement, which the SFWMD initiated in 2020; and 2) a spreader canal and pump station in the C-111 Basin that will be considered during planning for the CERP BBSEER project. Looking to further help Florida Bay, the SFWMD has recently installed two additional pumps to increase the amount of fresh water flowing into Taylor Slough by up to 10,000 acre-feet per year of water, bringing the total amount of new clean water being delivered to Florida Bay to as much as 44,000 acre-feet per year.

**Kissimmee River Restoration:** This restoration project will return the river to a more natural flow after having been channelized in the 1960s. The project involves restoring one-third of the Kissimmee River and its floodplain through backfilling 22 miles of canal, reestablishing flow to 40 miles of river channel, rehydrating 25,000 acres of river floodplain, modifying the S-65 regulation schedule, and implementing a comprehensive ecological evaluation program. There are two major contracts (Reach 2 Backfill, S-69 weir and backfill repairs, and Reach 3 south repairs) currently under construction. These contracts include canal backfilling, installation of erosion protection measures, and construction of the S-69 weir at the downstream terminus of the project. This is the last backfilling effort which will allow the rehydration of 25,000 acres of river floodplain during periods of high flow after implementation of the new regulation schedule. Upon construction completion, the Headwaters Revitalization Schedule will be implemented for the S-65 water control structure to provide enough flow to the Kissimmee River for floodplain restoration. Project ecological and hydrologic evaluation will continue to assess restoration progress in the Kissimmee River and floodplain and help inform ongoing restoration efforts.

Positive interim ecological responses are already being observed in the Reach 1 and Reach 4 areas, particularly in the river channel, where flow was reestablished in 2001 and has been maintained nearly continuously for almost 20 years. Organic deposits on the river bottom have decreased by 71 percent, new habitat for shorebirds and invertebrates has been established, and dissolved oxygen, critical for the long-term survival of fish and other aquatic organisms, has increased up to six-fold. Largemouth bass and sunfishes now comprise 63 percent of the fish community; prior to restoration, they represented only 38

percent. In the river channel, the reestablished flow eliminated organic deposits on the river bottom and undesirable floating and mat-forming plants have been replaced by native emergent plants. Sandbars reformed, creating new habitat for shorebirds and invertebrates. Dissolved oxygen, critical for the long-term survival of fish and other aquatic organisms, has improved six fold, although challenges remain to address short-term declines in dissolved oxygen that can affect recovery of native sunfish populations dramatically. Wading bird populations, including white ibis, great egrets, snowy egrets, and little blue herons, have increased significantly. Ducks have returned to the river, including American widgeons, northern pintails, northern shovelers, ring-necked ducks, and black-bellied whistling ducks. Wading bird foraging expectations are being met regularly when floodplain conditions are suitable, and snail kites nested in a newly flooded section of the Kissimmee River floodplain in the 2018 wet season with good success rates. Also on the floodplain, cover of wetland vegetation increased quickly overall after Reach 1 construction, meeting the expectation for wetlands, although the expected complement of specific plant communities has not yet reestablished. After construction is completed, implementation of the Headwaters Revitalization Schedule and appropriate water management are anticipated to provide the longer hydroperiods needed for reestablishment of broadleaf marsh communities.

**Modified Water Deliveries to Everglades National Park (Mod Waters):** The purpose of this Foundation Project is to improve natural water flows to Shark River Slough and ENP to help restore ecological functions, while providing flood mitigation and protection. The project consists of four major components: 1) flood mitigation for the residential 8.5 Square Mile Area; 2) conveyance and seepage control features to reconnect freshwater flows and control seepage out of ENP; 3) modifications to Tamiami Trail, including construction of a 1-mile bridge, to allow increased freshwater flows south into ENP; and 4) project implementation support that focuses on monitoring and operations. In 2015 the USACE initiated a series of incremental field tests that removed a trigger well constraint adjacent to the 8.5 SMA that limited inflows, and incrementally raised the eastern L-29 canal stage (from 7.5 feet in 2015 up to 8.5 feet in 2019). This change has promoted the highest inflow to Northeast Shark River Slough since the 1960s. Additional roadway improvements are being pursued within the Tamiami Trail Next Steps (TT:NS) project (see below).

All Mod Waters features were completed by June 2018 and development of COP, the new water control plan is underway with expected implementation by September 2020. Once this operational plan is finalized, average annual flows into the Northeast Shark River Slough portion of ENP will increase 130,000 ac-ft per year on average annually. This will allow the rehydration of the downstream ENP wetlands, relieve some of the adverse high water impacts upstream in WCA-3A, and create positive change for the area's substrate, flora, and fauna, Taylor Slough, and eastern Florida Bay. Rehydration will also increase the abundance of marsh fish and macro-invertebrates that support the historic wading bird colonies.

**Tamiami Trail Next Steps (TT:NS):** In 2012, the Congress approved the TT:NS project, which included up to 5.5-miles of additional bridging and reconstruction/raising of the remaining eastern roadway to support the higher water levels and flows envisioned in the CERP. Phase 1 of this project, completed in May 2019, constructed two bridges totaling approximately 2.8 miles, as well as limited roadway reconstruction, via a federal/state partnership. A Phase 2 plan was jointly developed by the NPS and the Florida Department of Transportation (FDOT) in mid-2019. The findings of recent Mod Waters incremental field tests indicate that the 3.8 miles of total bridging already completed will accommodate all future anticipated CERP flows. The Phase 2 focus will therefore be on reconstructing the remaining 6.5 miles of roadway (raising the roadway by approximately 3 feet) and adding six smaller bridges to improve flow distributions by targeting historic slough crossings. The FDOT will award the Phase 2 contract in August 2020 and construction will begin in October 2020, with a duration of approximately four years. The Phase 2 plan will allow for unconstrained flows under eastern Tamiami Trail into Northeast Shark River Slough, with the COP implementation. This final plan would fully support future federal and state restoration initiatives to redirect water flows from Lake Okeechobee back into the central/southern Everglades and Florida Bay.

**Southern Corkscrew Regional Ecosystem Watershed (CREW):** This hydrologic enhancement project consists of a 4,150-acre mosaic of wet prairies, native uplands, freshwater marsh, hydric pine flatwoods, and cypress strand wetlands. The project will restore historical sheetflow and reduce excessive freshwater discharges which include nutrients and pollutants to Estero Bay during the rainy season. This will have a

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significant benefit to the wetland areas in the watershed as well as improving conditions in Estero Bay. Construction of the Southern CREW project was initiated in February 2016 and completed in April 2018. The SFWMD has led this restoration effort with its partners, including the USDOJ. Based on vegetation data collection efforts to date, a trend of appropriate wetland vegetation recruitment has been observed and it is anticipated that as a result of the hydrologic enhancements, further increases in native wetland vegetation will follow.

# WATER QUALITY

The objective of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. In order to achieve this objective, water quality standards (WQS) which provide for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water, are established by states. Applicable State of Florida WQS are the foundation for a wide range of programs under the CWA, including establishing water quality goals for specific waters bodies and are the regulatory basis for water quality-based effluent limits through federal permits. WQS also serve as a target for CWA restoration activities such as total maximum daily loads (TMDLs). Water quality within the ecosystem has been compromised by a variety of nutrients and pollutants. Excess phosphorus, often evidenced by excessive cattail growth or widespread algal blooms, is a major concern for the central Everglades as well as for the ecosystem's lakes and estuaries, but it is not the only problem. Other nutrients, too little or too much fresh water, mercury, and potentially toxic contaminants such as trace metals, pesticides, and other synthetic organic chemicals, are also of concern. However, most of the state and federal water quality programs described here focus on nutrient reduction.

## STORMWATER TREATMENT AREAS (STAs)

STAs are constructed treatment wetlands that remove and store nutrients through plant growth and the conversion of dead plant material into soil. Approximately 68,000 acres of land south of Lake Okeechobee have been converted from row crop fields to STAs, yielding 63,000 acres of effective treatment wetlands. In Water Year (WY) 2019 and WY 2020 (May 2018 - April 2020), the Everglades STAs treated an average of 1.1 million acre-feet of water and retained 130 metric tons of phosphorus (P) per year, which equates to an 80 percent P load reduction, and produced an average outflow P concentration of 24 micrograms per liter. STAs located north of Lake Okeechobee include the Lakeside Ranch STA, which will help improve water quality flowing into the lake, and the Lake Okeechobee Water Retention and Phosphorus Removal Project/Taylor Creek and Nubbin Slough STAs, which capture and treat inflows and subsequently release cleaner water back into Taylor Creek, Nubbin Slough, and Lake Okeechobee.

## RESTORATION STRATEGIES

One of the State of Florida's largest water quality programs underway is Restoration Strategies, a consensus plan developed collaboratively by the State of Florida and the U.S. Environmental Protection Agency (USEPA) with an estimated cost to Florida of \$880 million. Under this program, the SFWMD is designing, constructing, and operating a suite of regional water storage, treatment, and conveyance improvement projects that is envisioned to further improve water quality in America's Everglades. The program also includes a robust STA Science Plan consisting of research activities focused on investigating the critical factors that influence P reduction and better understanding the sustainability of P removal performance at low P concentrations. The strategies also feature implementation of additional sub-regional source controls – where pollution is reduced at the source – in areas where P levels in stormwater runoff have been historically higher. Within the timeframe of this report, 13 milestones have been accomplished ahead of schedule. The operational monitoring and testing period for the A-1 FEB has been completed and it is now in routine operation. Permit applications have been submitted for the C-139 FEB and the design is on-going. Construction of the STA-1W Expansion #1 was completed. Land acquisition was completed and permit applications were submitted for the STA-1W Expansion #2. The design for Expansion #2 is on-going. In STA-5/6, internal earthwork improvements have been completed over an area of 1,100 acres, increasing the effective treatment area of the STA. Through April 2020, total program expenditures by the SFWMD were approximately \$339 million and all projects are scheduled to be completed by December 2025.

## EAA REGULATORY BEST MANAGEMENT PRACTICES PROGRAM

Best Management Practices (BMPs) are source control efforts to reduce the amount of pollutants (pesticides, fertilizers, animal waste, etc.) in agricultural or urban runoff. Agricultural BMPs are designed to increase efficiency in nutrient and irrigation water management to balance agricultural production with water resource protection. The SFWMD's regulatory BMP program in the EAA Basin is an example of how BMPs can play a major role in restoration. For over 25 years, the SFWMD's regulatory program has exceeded expectations, most recently with a 68 percent reduction in total phosphorus (TP) loads in WY 2020 compared to the baseline period prior to the BMP program implementation. Results have been consistently above the 25 percent load reduction mandated by Florida Statutes, averaging 56 percent over the long-term. The SFWMD BMP program has prevented approximately 3,886 metric tons of TP from entering the Everglades for the period WY 1996 through WY 2020.

## NORTHERN EVERGLADES AND ESTUARIES PROTECTION PROGRAM

The Northern Everglades and Estuaries Protection Program (NEEPP) recognizes that the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds are critical water resources of the State of Florida. This program builds upon and consolidates numerous restoration activities into a comprehensive, regional approach. Watershed Protection Plans (WPP), developed pursuant to the NEEPP for each of the three watersheds, identify actions to help achieve water quality and quantity objectives and restore habitat. They are also the basis for the Florida Department of Environmental Protection (FDEP) basin management action plans (BMAPs) detailed in the following section. Implementation of the NEEPP by the coordinating agencies is underway and annual updates can be found in the South Florida Environmental Report ([www.sfwmd.gov/sfer](http://www.sfwmd.gov/sfer)).

## BASIN MANAGEMENT ACTION PLANS/WATERSHED PROTECTION PLANS

A variety of basin-specific planning efforts identify water quality standards and detail mechanisms to achieve and maintain those standards. TMDLs are scientifically determined maximum amounts of a pollutant that a surface water body can absorb and still meet water quality standards that protect human health and aquatic life. FDEP-adopted BMAPs, supported by the SFWMD, FDACS and WPPs, promote a comprehensive, interconnected watershed approach for identifying upstream measures to improve water quality in, and hydrology to, downstream water bodies. BMAPs are the framework for water quality restoration, containing local and state commitments to reduce pollutant loading through current and future projects and strategies. Reasonable Assurance Plans (RAPs) are a possible alternative to TMDLs and BMAPs for certain surface waters that already have control programs in place that will ensure water quality standards will be restored. An update on key planning efforts is highlighted below.

### **Caloosahatchee River/St. Lucie River/Lake Okeechobee Watershed Protection Plans (LOWPPs):**

The purpose of these plans is to improve the hydrology and aquatic habitats of Lake Okeechobee and downstream receiving waters, including the Caloosahatchee and St. Lucie rivers and estuaries, for the restoration and protection of these Northern Everglades ecosystems. In accordance with NEEPP-mandated timelines, the LOWPP Update was revised in 2020 (2020 SFER). Future updates to the WPPs will be done in accordance with the 2016-amended NEEPP to ensure that they are consistent with the adopted BMAPs for Lake Okeechobee and the St. Lucie and Caloosahatchee river watersheds.

### **Caloosahatchee River and Estuary/St. Lucie River and Estuary/Lake Okeechobee BMAPs:**

In 2019, the FDEP adopted dissolved oxygen TMDLs for five Caloosahatchee River tributaries, which established reduction targets for total nitrogen (TN), TP, and biochemical oxygen demand. In response to Executive Order 19-12, to expedite improvement to water quality, all three BMAPs were updated by FDEP

in January 2020 and adopted by secretarial order in February 2020. Notably, this was the first 5-year review for the Lake Okeechobee BMAP since NEEPP was amended in 2016. Also, the latest Caloosahatchee River and Estuary BMAP update incorporates the expanded area that includes the state's newly adopted Caloosahatchee River Tributary TMDLs. The state's annual progress reporting on the BMAPs also continues. The second Florida Statewide Annual Report (STAR) was published on July 1, 2019 per statutory requirements. The STAR for the 2019 reporting was published by FDEP on June 30, 2020. ([www.floridadep.gov/dear/water-quality-restoration/content/basin-management-action-plans-bmaps](http://www.floridadep.gov/dear/water-quality-restoration/content/basin-management-action-plans-bmaps))

**Florida Keys National Marine Sanctuary (FKNMS) Water Quality Protection Program (WQPP):** The FKNMS WQPP is a congressionally authorized program that is dedicated to protecting and improving water quality, coral reefs, seagrasses, fisheries, and recreational opportunities within the FKNMS and adjacent boundary waters. Co-chaired by the USEPA and the FDEP in consultation with the NOAA, the WQPP is a collaborative program driven by a Steering Committee comprised of federal and state resource managers, local governments, elected officials, non-governmental organizations, academia, and local citizens that meet biannually to identify and address water quality issues impacting marine resources within the FKNMS. During this reporting period, a Canal Restoration Guidance Document was developed and the WQPP Steering Committee began a process to update and prioritize water quality improvement strategies. Funding was provided by the USEPA to continue water quality, coral reef, and seagrass monitoring programs and fund a number of special studies and other WQPP initiatives, including research on Stony Coral Tissue Loss Disease and endocrine disruptors, sponge restoration, and the development of a voluntary boater education course for residents and visitors.

([http://ocean.floridamarine.org/FKNMS\\_WQPP/](http://ocean.floridamarine.org/FKNMS_WQPP/))

**Florida Keys Reasonable Assurance Document (FKRAD):** The FKRAD was developed in 2008 by FDEP in cooperation with local, state, and federal agencies to set forth and accelerate actions to reduce nutrient loadings into nearshore waters throughout the Florida Keys. In 2011, the FKRAD was updated to additionally address dissolved oxygen impairments for some water bodies. As part of this plan, Monroe County and its municipalities have been implementing advanced wastewater treatment throughout the Florida Keys. The Florida Keys were reassessed and the FKRAD again updated in 2017–2018 to provide the status of management activities. At that time, most of the planned restoration projects had been implemented, but it was determined that more monitoring was needed to assess the success of the plan. During this reporting period, the FDEP and Monroe County worked together to put a monitoring program in place to focus on nearshore water quality. Results from this effort will be reported in the next update to the FKRAD in 2022.

## OTHER WATER QUALITY INITIATIVES

**Dispersed Water Management Program (DWM):** As part of an ongoing effort to maximize water storage in the greater Everglades system, the SFWMD continues to partner with agencies and private landowners to bolster the DWM Program. Detaining or treating water on public and private lands is one tool to help reduce the amount of water flowing into Lake Okeechobee and/or released to the Caloosahatchee and St. Lucie estuaries during times of excess water conditions throughout south Florida. The SFWMD has led efforts to plan, implement, or operate: one Florida Ranchlands Environmental Services Project; first solicitation of eight Northern Everglades Payment for Environmental Services projects; seven second solicitation projects on ranchlands; two water farming projects; six large public/private projects under NEEPP; and nine projects on SFWMD-owned lands. Since its inception in 2005, the DWM Program's estimated average annual retention volume has grown to more than 123,000 acre-feet per year in operation and maintenance, with an additional estimated average annual retention volume of over 257,000 acre-feet per year in the planning, design/permitting, or construction phase. From 2018 to 2020, the State of Florida appropriated \$34.9 million to expand the DWM program.

**C-43 Water Quality Treatment and Testing Facility Project (C-43 WQTTP):** The SFWMD, in partnership with Lee County, is conducting the C-43 WQTTP to help demonstrate and implement cost-effective, wetland-based strategies for reducing nutrient loadings, particularly nitrogen (N), to the Caloosahatchee River and its downstream estuarine ecosystems. The Phase I Field testing for the mesocosm study was

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completed in December 2018. The final report for the C-43 WQTP Phase I was published in August 2019. The Phase II test cells study was initiated in January 2020. The primary objective of the Phase II study is to evaluate N removal treatment technologies to optimize efficiencies and improve upon the general understanding of N reduction in constructed wetland systems. The Phase II research demonstration will be conducted at the SFWMD-owned Spoil Management Site in Moore Haven and in support of a future full-scale treatment facility.

**C-43 Water Quality Feasibility Study:** In 2019, a State of Florida Executive Order was signed which called for greater protection of Florida's environment and water quality, particularly in relation to the harmful blue-green algal blooms in south Florida. Specifically, the Executive Order directed the FDEP to work with the SFWMD to add a stormwater treatment component to the C-43 West Basin Storage Reservoir (WBSR) with the intent of providing additional treatment and improving the quality of water leaving this important storage component of the CERP. This initiative is being implemented through the state's C-43 WBSR Water Quality Feasibility Study.

**FDACS Agricultural Best Management Practices Program:** Agricultural BMPs are designed to increase efficiency in nutrient and irrigation water management to balance agricultural production with water resource protection. BMPs are practical, cost-effective actions that agricultural producers can take to conserve water and reduce the amount of nutrients (fertilizers and animal waste) and other pollutants entering water resources. BMPs are designed to benefit water quality and water conservation while maintaining or even enhancing agricultural production. Categories of practices include nutrient management, irrigation management, and water resource protection features, FDACS develops and adopts BMPs by rule for different types of agricultural commodities. Florida law provides for agricultural producers to reduce their impacts to water quality through the implementation of BMPs adopted by FDACS.

**Hybrid Wetland Treatment Technology (HWTT):** Managed by FDACS, HWTT systems combine attributes of STA treatment wetlands with chemical treatment systems. There are currently 8 operational HWTT systems within the SFWMD boundaries, 5 in the Lake Okeechobee Watershed (Nubbin Slough, Mosquito Creek, Lemkin Creek, Grassy Island, and Wolff Ditch) and 3 in the St. Lucie River Watershed (Ideal 2 Grove, Bessey Creek, and Danforth Creek). From July 1, 2019 to June 30, 2020, the five Lake Okeechobee Watershed facilities treated a total of 3,089 million gallons, removing 4.2 metric tons of TP. TP flow-weighted mean concentration (FWMC) reductions ranged from 79 to 94%, while TN reductions averaged approximately from 25 to 56%. From July 1, 2019 to June 30, 2020, the three St. Lucie River Watershed facilities treated 1,514 million gallons, removing 1.3 metric tons of TP. FWMC TP reductions ranged from 83 to 91%, while TN reductions averaged approximately from 32 to 52%.

**Floating Aquatic Vegetation Tilling (FAVT):** Managed by the FDACS, FAVT systems utilize floating plants to absorb nutrients that are then composted to provide new soil for the FAVT system. The 540-acre East Caloosahatchee site is designed to treat local agricultural runoff from the Hendry Hilliard Water Control District, the East Caloosahatchee River, and Lake Okeechobee. The East Caloosahatchee FAVT facility removes approximately 83% of the inflow TP load on an annual basis. From July 1, 2019 to June 30, 2020, a total of 6,384 million gallons (24.2 million m<sup>3</sup>) was treated removing 2.1 metric tons of TP. The Fisheating Creek facility, located in the Lake Okeechobee watershed, is comprised of 250 acres of floating aquatic vegetation and SAV communities. In 2016, this facility became operational and is currently in an optimization phase, which is anticipated to be completed in 2020. Load reductions will be determined after optimization is completed. From July 1, 2019 to June 30, 2020, a total of 1,922 million gallons was treated removing 1.4 metric tons of TP. The 140-acre North Feeder Canal site is designed to treat local stormwater runoff collected within the on-site canal network and runoff from the upstream agricultural areas located west of CR 833 that discharge to the South Boundary Canal. The facility is located in the North Feeder Canal Basin which is a sub-basin of the L28i Basin. The North Feeder Canal facility removes approximately 76% of the inflow TP load on an annual basis. From July 1, 2019 to June 30, 2020, a total of 2,488 million gallons (9.4 million m<sup>3</sup>) was treated removing 0.9 metric tons of TP. The 255-acre L28i facility, also located in the North Feeder Canal Basin, is designed to treat local stormwater runoff collected within the on-site canal network and runoff from the upstream agricultural areas located west of CR 833 that discharge to the South Boundary Canal. The facility was constructed during 2018 and was in the initialization and grow-in phases during 2019. Load reductions will be determined after optimization is completed. From July 1, 2019

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to June 30, 2020, a total of 1,404 million gallons (5.3 million m<sup>3</sup>) was treated removing 0.9 metric tons of TP.

**Coral Reef Water Quality Monitoring:** The FDEP Coral Reef Conservation Program established an offshore water quality monitoring program for Martin, Palm Beach, Broward, and Miami-Dade counties. Monthly samples are being taken at surface and bottom for all inlets and ocean outfalls, as well as across multiple coral reef sites. The FDEP is currently developing coral reef-specific numeric nutrient criteria for turbidity.

# HABITAT PROTECTION AND RESTORATION

Historically, the natural habitats of south Florida covered an area of about 18,000 square miles. A combination of connectivity and spatial extent created the range of habitats and supported the levels of productivity needed for the historic diversity and abundance of native plants and animals. Successful restoration of the South Florida Ecosystem will require land acquisition and conservation to protect natural habitats and species, as well as conservation and management of the region's estuaries and marine habitats, including coral reefs.

## LAND ACQUISITION

The Florida Forever program was established in 2000 by the Florida Legislature to conserve environmentally sensitive land, restore waterways, and preserve important cultural and historical resources. In 2008, the Florida Legislature authorized an additional \$3 billion through 2020.

Florida's Land Acquisition Trust Fund was developed to acquire and improve conservation easements, wildlife management areas, wetlands, forests, fish and wildlife habitats, beaches and shores, recreational trails and parks, urban open space, rural landscapes, working farms and ranches, historical and geological sites, lands protecting water and drinking water resources, and lands in the EAA and the Everglades Protection Area. The fund was designed to manage and restore natural systems and to enhance public access and recreational use of conservation lands. The 2014 Florida Water and Land Conservation Initiative, Amendment 1, was designed to dedicate 33 percent of net revenue from the existing excise tax on documents to the Land Acquisition Trust Fund.

Of the approximately 385,000 acres of land needed for potential CERP projects, approximately 65% (250,956 acres) have been acquired as of December 31, 2019, leaving approximately 134,044 acres that still need to be acquired.

### **State Land Acquisition during the reporting period:**

- SFWMD acquired 5,300 acres for Conservation and Restoration Projects
- FDEP acquired just over 100 acres for the Picayune Strand Restoration Project

### **Completed State Land Acquisition:**

- 27 projects have been completed.
- 38 projects are underway.

## LAND CONSERVATION

Agriculture is Florida's second leading industry and a large portion of agricultural land can be viewed as open space that benefits the natural system through buffering, revitalization of natural habitats, water storage and filtration, and aquifer recharge. The USDA – Natural Resources Conservation Service (NRCS) provides technical and financial support to help landowners with their wetland restoration efforts. The NRCS's goal is to achieve the greatest wetland functions and values, along with optimum wildlife habitat, on every acre enrolled in the program.

**Agricultural Conservation Easement Programs (ACEP) in Florida:** During the reporting period, the USDA invested over \$42 million in ACEP funds for the acquisition and restoration of 21,500 acres of land in Florida. Over 75% of this investment was within the Northern Everglades Initiative area. For 2018-20, Florida once again received one of the largest ACEP funding allocations in the nation.

**Fisheating Creek Wetland Restoration Project:** The NRCS has acquired permanent conservation easements in the Fisheating Creek Wetland Restoration Project area. The planned restoration activities will

reduce the amount of surface stormwater leaving the land, slowing water runoff and reducing the concentration of nutrients entering Lake Okeechobee and the Everglades. Restoration activities began in 2019, and in 2020 restoration was completed on 7,867 acres. Restoration activities are scheduled to begin on another 14,200 acres in 2021.

## ESTUARY AND CORAL REEF PROTECTION

**Biscayne National Park Coastal Restoration Efforts:** In 2018-19, the USACE and the SFWMD continued to move forward with construction and operation of the BBCW Phase 1 project (see CERP, Generation 2 Projects, in this document) and have begun to document improvements in coastal vegetation and estuarine conditions downstream of the completed portions of the project. In addition, a new bird nesting colony has been documented in the mangrove shoreline within the project area. While year-to-year variability is high, there has been a measurable decrease in both surface water and soil porewater salinity as well as an increase in freshwater levels downstream from the Deering Estate pump station. The temporary 25 cfs pumps for the L-31E canal and new culverts to distribute freshwater flow have had direct ecological benefits on the neighboring marsh including new recruitment of freshwater tolerant species directly downstream of the culverts. These moderate increases in freshwater flow are anticipated to provide benefits for the coral reef zone. Coral reefs within BNP are experiencing impacts from Stony Coral Tissue Loss Disease (SCTLD). At this time, it is estimated that only 8% of the historic reef cover remains viable. (See SCTLD update below.) Larger system-wide benefits of this restoration project and the newly initiated BBSEER project are anticipated as additional freshwater is delivered to the bay through new and existing water management features.

**Fisheries Management Efforts:** During the reporting period, the FWC and the NOAA Fisheries enacted conservation measures to either recover or maintain sustainable populations of several species that rely on estuaries and nearshore coral reefs of the South Florida Ecosystem for part of their life cycle. Fish habitat conservation and protection efforts are focused on coral reefs and other nearshore marine and estuarine habitats that have been designated as Essential Fish Habitat including hard bottom, mangrove wetlands, estuarine emergent marsh, submerged aquatic vegetation, and coastal inlets. Species include hogfish, mutton snapper, red snapper, spiny lobster, red grouper, gag grouper, gray triggerfish, and yellowtail snapper.

**Endangered Species:** The conservation, restoration and protections of native habitats within south Florida can assist the conservation and recovery of listed species as the Endangered Species Act (ESA) indicates “The purpose of this Act are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved...” The diverse efforts of the CERP including the operational changes to the C&SF Project will affect the habitats in south Florida that ESA-listed species rely upon.

NOAA Fisheries and USFWS share responsibility to protect plant and animal species under the ESA. Lists of the endangered and threatened species within and adjacent to CERP activities are available at the following websites:

- Florida Atlantic Coast - <https://www.fisheries.noaa.gov/content/florida-atlantic-coast>
- Florida Gulf Coast - <https://www.fisheries.noaa.gov/content/florida-gulf-coast>
- South Florida Listed Species - <https://www.fws.gov/verobeach/>

Collectively NOAA Fisheries and USFWS continue to participate in the Task Force and provide information on how restoration efforts may conserve and recover ESA-listed species (including fish, corals, mammals, birds, reptiles, invertebrates and plants) and the habitats they rely upon.

**Coral Reef Conservation Program (CRCP)/Southeast Florida Coral Reef Initiative (SEFCRI):** The FDEP’s CRCP coordinates coral reef research, monitoring, and mapping, conducts education and outreach, develops management strategies, and encourages partnerships and stakeholder participation to advance protection of Florida’s Coral Reef. The CRCP leads the implementation of SEFCRI, a local action strategy for collaborative action among over 60 government and non-governmental partners to reduce key

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threats to coral reef resources off Miami-Dade, Broward, Palm Beach, and Martin counties. During 2018-2020, the SEFCRI Team has been implementing priority projects identified in their 2017 Local Action Strategy five-year action plan. The Southeast Florida Coral Reef Ecosystem Conservation Area in state waters from the northern boundary of BNP to the St. Lucie Inlet was established on July 1, 2018.

**Coral Restoration Efforts:** In late 2019, the NOAA announced the launch of *Mission: Iconic Reefs*, a bold initiative to restore seven ecologically and culturally significant coral reefs within the FKNMS. This ambitious, multi-decade effort will build upon years of research and previous restoration efforts and go beyond traditional out-planting to include a greater diversity of stony coral species, the introduction of algae grazing species, removal of nuisance species and coral predators, and community stewardship in maintaining restoration sites. During this reporting period, the Coral Restoration Foundation and Mote Marine Laboratory significantly scaled up outplanting within the FKNMS. Over 54,000 staghorn coral fragments, and 25,000 elkhorn coral fragments were outplanted in 2019, which represents two to four times more than was outplanted in 2018. Additional coral nurseries have been added to the Florida Keys and a new restoration practitioner has also begun work in Florida. Numerous other agency and NGO partners participate in coral restoration activities along the Florida Reef Tract and the collective efforts of this group continue to advance coral restoration science. Novel restoration strategies have been directed towards outplanting of multiple corals at one time, new methods of attachment, maximizing genetic diversity and stress-tolerant genotypes, and outplanting novel genotypes of corals reared in laboratory settings at restoration sites.

**Coral Disease Outbreak Multi-Agency Response:** Since it first emerged in 2014, a severe outbreak of SCTLD has continued to progress throughout the Florida Reef Tract. This widespread and lethal coral disease outbreak affects nearly half of Florida's reef-building coral species and has high rates of transmission and mortality. Disease has spread to the northern extent of the Florida Reef Tract and south through BNP into the FKNMS. As of this reporting period, disease has progressed past Key West and to the western end of the Marquesas, but has not yet reached the Dry Tortugas. The FDEP, the NOAA, the FWC, and the NPS are co-leading the response along with numerous other federal, state, and local government entities, universities, NGOs, and the community at large. This multi-faceted response effort includes: (1) reconnaissance and field data collection; (2) sampling, analysis, and experimentation to better understand the disease dynamics and identify the primary and secondary causes; (3) investigating potentially contributory environmental conditions; and (4) identifying management and intervention actions to slow or stop the spread of disease. While these disease-specific response efforts are ongoing, parallel efforts to ensure the presence of environmental conditions required for coral survival, such as improvement to nearshore water quality through the CERP, will be necessary to ensure the long-term survival and recovery of these resources.

Partner agencies have continued to characterize the distribution, prevalence, and severity of the disease and are continuing work to identify causative agents and linkages with environmental factors. The USEPA provided funding to support the collective response effort including a full-time disease response specialist position and support for data management and reporting. Meanwhile, scientists have initiated field-based experimental lesion-level antiseptic and antibiotic treatments on corals across the reef tract in an attempt to mitigate disease impacts, reduce disease spread, and save high-priority coral colonies. New techniques to treat whole colonies using probiotics are also being tested. Following successful laboratory attempts by BNP to salvage pieces of infected colonies of a threatened pillar coral, the NOAA and the State of Florida have initiated an unprecedented effort to rescue corals from the wild ahead of the moving disease margin. Efforts are underway to collect 4,000 colonies across 22 species from reefs in Florida that have not been exposed to SCTLD to preserve as many unique genotypes as possible, so that those corals can be propagated and eventually returned to the reef. This effort has resulted in the development of markers to identify unique genetic strains of susceptible corals and successful lab-based spawning and grow-out of boulder coral species that had never been cultured. In partnership with the Association of Zoos and Aquariums, currently over 1,600 colonies are being housed in land-based aquaria across the country.

**Marine Debris Removal Efforts in FKNMS:** The FKNMS and the National Marine Sanctuary Foundation launched *Goal: Clean Seas Florida Keys* in response to the significant amount of debris left in the wake of 2017's Hurricane Irma. This community-based program engages local tour operators and other businesses

in removing derelict lobster traps, fishing gear, construction materials, and other items that pose significant pollution and navigation threats. This program further engages volunteers in monthly shoreline and kayak-based cleanups. During this reporting period, the program has removed over 24,500 pounds of debris from sanctuary waters. Divers have committed over 1,246 volunteer hours underwater contributing to this work and have removed over 25,000 feet of line from the reefs.

**FKNMS Resource Planning Efforts:** During this reporting period, the FKNMS continued progress on the first comprehensive review of the sanctuary's management plan since 1997. The draft suite of proposed changes, known as the Restoration Blueprint, was released in August 2019 with an open public comment period through January 2020. Public comment was reviewed and carefully considered in coordination with the FKNMS Advisory Council, Fishery Management Councils, and state partners, among others. Next, a revised draft single alternative will be released, during which there will be another opportunity for review and comments from the public. The FKNMS Advisory Council continued to hold regular public meetings during the reporting period. These meetings are designed to inform members about ecological and sociological issues related to sanctuary resource management, and to update and solicit input from members and their stakeholder groups about the Restoration Blueprint.

**Our Florida Reefs :** This program was designed to increase public involvement in the future management of southeast Florida's coral reefs by seeking input from community members on the development of recommendations that can become part of a comprehensive management strategy to ensure healthy coral reefs in the Southwest Florida Coral Reef Ecosystem Conservation Area. A follow-up project is currently seeking management recommendations from stakeholders. Additionally, the FDEP's CRCP is working to incorporate these recommendations into a management strategy.

**Biscayne Bay Habitat Focus Area (HFA):** Biscayne Bay and its nearshore reef, including the state BBAP, BNP, and the upper part of the FKNMS (Manatee Bay, Barnes Sound, and Card Sound), were designated a NOAA HFA in the NOAA Habitat Blueprint Initiative. The implementation plan completed in 2016 contains four goals that address the quality of bay and reef habitat for protected and fishery species and the people of the region and the nation. The first three goals are to: (1) improve and protect water quality; (2) increase and protect freshwater inflows; and (3) reduce physical damage to seagrass, coral, mangrove shoreline, and other bay habitats. Applied studies are being used to develop scientific information to shape the most effective approaches to addressing these goals. For example, considerable progress has been made on determining the most effective ways to prevent stimulation of algal blooms by nutrients. Three papers have been published on this topic out of HFA-sponsored efforts. Progress also is being made to learn more about the historic and current presence and habitat of the smalltooth sawfish in Biscayne Bay, which is the topic of another paper currently in review. The fourth goal is to acquire information on socio-economics and ecosystem services to help citizens, managers, and policy makers better understand the bay's economic, social, and ecological benefits to human systems and the importance of gaining and maintaining the long-term good health of Biscayne Bay and its reef tract now and into the future. The NOAA HFA grants to a local non-governmental group have been especially effective in addressing this goal.

**Biscayne Bay Aquatic Preserves (BBAP):** In May 2018, the BBAP initiated research into the Tuttle Basin seagrass loss with benthic habitat assessments and seagrass and macroalgae tissue sampling for isotopic analyses. Water quality sampling initiated in January 2019 with monthly bottle grab sampling for nutrients, pharmaceuticals, sucralose, herbicides, fungicides, and insecticides and continuously monitoring datasonde (high frequency water quality monitoring) stations. The highest values of nutrients were found to be entering the Tuttle Basin via the Little River.

The Little River is connected to Lake Okeechobee via the Miami Canal and runs through multiple municipalities with high septic utilizing parcels. A USEPA funded expansion of the current sampling design will emulate the Tuttle Basin project with a focus on the Miami River and Rickenbacker Basin. Sampling initiation is expected to begin in fall 2020.

**Florida Keys Aquatic Preserves (FKAPs):** Three FDEP managed aquatic preserves fall within the FKNMS: Biscayne Bay– Card Sound, Lignumvitae Key (LKAP), and Coupon Bight (CBAP). During this reporting period, a dedicated staff position was created to oversee the management of LKAP and CBAP

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and the valuable resources found within both preserves. The focus of activities during the reporting period included establishing water quality monitoring sites, increasing community awareness and appreciation of the preserves' resources, post-Hurricane Irma response, marine debris removal, and ecosystem monitoring.

**Studying Impacts of Hurricane Irma:** Following Hurricane Irma, which plowed across the lower Florida Keys on September 10, 2017 and brushed mainland south Florida, a special issue of *Estuaries and Coasts*, the journal of the Coastal and Estuarine Research Federation (CERF), published scientific papers about physical and ecological responses of natural systems to the 2017 hurricanes, Irma, Harvey, and Maria. The July 2020 special issue was organized by local south Florida scientists from SFWMD, NOAA, University of Miami, and Florida International University and contained contributions from these entities as well as the USGS, NPS, Florida Atlantic University, and many others. Thirteen of the 25 papers in the special issue related to Irma's impacts on south Florida.

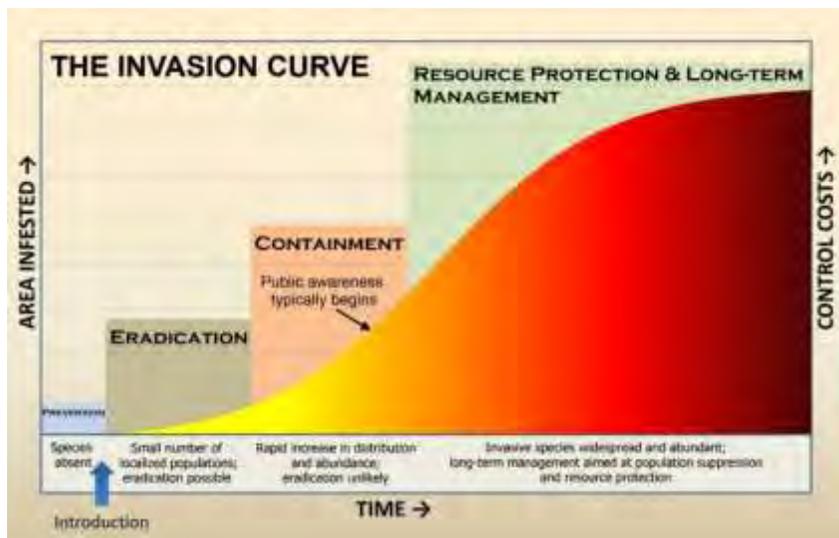
One paper described the storm's influence on Biscayne Bay water quality from response through recovery, following changes in nutrient concentrations and phytoplankton community composition. A Florida Bay study pointed out the similarity of the series of events following Irma, including a post-hurricane fish community change to the pelagic species bay anchovy, to the series of events that followed Hurricane Andrew almost 30 years prior. In both cases, a hypersaline event, seagrass die-off, and an algal bloom preceded the hurricane's passage. Long-term monitoring programs provided the background for assessing Hurricane Irma's impacts on seagrass communities of Florida Bay and the FKNMS. The assessment indicated a post-hurricane decline in seagrass cover in coastal Florida Bay and Lower Florida Keys bayside and no declines elsewhere. A before-after study of hurricane impacts on stony corals, based on impacts to the black sea urchins that keep algal overgrowth of corals in check, was thwarted by low urchin population sizes in study locations both before and after Irma's passage, and pointed to the need to study sea urchin populations in the FKNMS more broadly. Another study followed fourteen tagged juvenile bull shark behavior in the shallow Shark River Estuary in relation to the approaching storm. Eleven moved out of the estuary within days or hours ahead of the storm's passage, but three may have tried to leave too late and probably died. Rate and extent of decline in barometric pressure was one likely cue prompting directed downstream movement. The effect of Irma on the freshwater lens of a Florida Keys Island was detailed in another study, which observed immediate storm surge replacement of fresh water with salt water and recovery of the former freshwater lens within 8 months. Other studies measured effects of hurricane surge and winds on sediment deposition, erosion rates, mangrove defoliation, and delayed death on Florida Bay islands and southwest coast mangrove forests. Investigators noted that recovery of mangrove fringes and forests depends on regrowth of surviving canopy, development of existing understory, and recruitment and survival of new propagules. However, locations with high tree mortality are at risk of peat collapse and land loss.

Results of these studies and those following previous storms will help scientists and resource managers to better understand and prepare for changes that may accompany future storms in the context of sea level rise and other long-term trends in oceanic conditions and climate.

# INVASIVE EXOTIC SPECIES

Florida has the highest severity of threats posed to native habitats and species by invasive exotic species in the continental United States. Florida’s subtropical climate, major ports of entry, large-scale pet and aquarium commerce, and agricultural and ornamental plant industries contribute to the state’s vulnerability to biological invasions. Invasive exotic species are detrimental to America’s Everglades, causing harm to native species including threatened and endangered species through predation, food web disruption, resource competition, physical changes to habitats, and disruptions to unique ecological processes and functions.

Recognizing the importance of protecting valuable resources by managing the growing threats of these and other invasive exotic species, the Task Force has developed an Invasive Exotic Species Strategic Action Framework (Framework). First issued in 2015, the Framework was updated during this reporting period. It is accompanied by an interagency snapshot budget, a five-year progress report, updated priorities, and case studies. The case studies are included as Appendix B in this document. The 2020 Framework and associated materials will be available on EvergladesRestoration.gov. The Framework is organized along the four phases of the Invasion Curve: Prevention, Early Detection and Rapid Response (EDRR), Containment, and Long-term Management /Resource Protection. Updates on progress during the reporting period are reported according to these four phases below.



## PREVENTION

Preventing the introduction of invasive exotic species protects the South Florida Ecosystem from the negative ecological and economic impacts of those species and the subsequent high costs associated with long-term control efforts. Prevention requires the ability to identify pathways to stop harmful exotic species from entering the South Florida Ecosystem.

**Prevention at Ports: State border law enforcement agencies at the ports (FWC and FDACs) have expanded the use of detector dogs.** K-9 teams are trained to detect the most common wildlife trafficked items that are seized at their duty stations and can work in air and seaports and international mail facilities. The FWC currently has two K-9 Teams in south Florida. Additionally, the FWC is in the process of developing tools that assess the risk of species before they enter the ecosystem through the ports.

**Prevention through Public Outreach:** The FWC’s Exotic Pet Amnesty Program (EPAP) reduces the number of nonnative species released into the wild by allowing pet owners to surrender exotic pets, whether kept legally or illegally, without penalty or cost. EPAP. Since 2015, FWC has hosted 19 EPAP events with

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over 3,700 pets being surrendered, 430 of which were regarded as “conditional” animals that are restricted from being acquired or kept as pets. Pet owners can surrender unwanted pets at Exotic Pet Amnesty Day events or by calling 1-888-IVEGOT1. The FWC and partner agencies also continued to utilize the “Don’t Let It Loose” campaign to encourage responsible pet ownership and prevent release of nonnative wildlife into Florida.

**Prevention through Regulation:** The federal Lacey Act prohibits the importation of species that are designated as injurious. However, in 2017, the D.C. Circuit Court ruled that the Lacey Act does not prohibit interstate transport of injurious wildlife within the continental United States. In response to the court ruling, the FWC recently added 13 species to Florida’s Prohibited Species list, of which three constrictors (Yellow anaconda, Beni anaconda, and DeSchauensee’s anaconda) were of particular concern to the Everglades ecosystem and its restoration. These rule changes became effective on May 2, 2019. The FWC continues to work with universities and other research partners to determine risk associated with other species in trade. <https://myfwc.com/wildlifehabitats/nonnatives/rule-development/>

## EARLY DETECTION AND RAPID RESPONSE

It is imperative to respond quickly and deal with emerging threats while they remain localized. After prevention, eradication through EDRR is the second most cost-effective method to deal with invasive exotic species. EDRR activities include decision tools to determine which exotic species pose high risks to the ecosystem if introduced, agency monitoring and public reporting of sighted invasive species, and response teams that can quickly implement eradication efforts.

### Decision Tools

**EDRR Decision Framework/Screening Tool:** The USGS funded the University of Florida (UF) to develop a response decision support tool (screening tool) that ranks nonnative animal species by how likely they are to successfully invade the Everglades. The tool helps managers decide whether to rapidly respond to a sighting or if additional in-depth risk assessment is needed. During the reporting period, the FWC adapted the tool for statewide use and will continue to work with UF to refine and improve it. To date, FWC has conducted 15 risk screenings using this tool. A similar risk assessment tool, also developed by UF, is utilized for potentially invasive plant species in Florida.

### Monitoring

**Monitoring for Invasive Plants:** The SFWMD, in collaboration with the NPS, USFWS, and other agency partners, conducts landscape-scale monitoring for priority invasive exotic plants in America’s Everglades. The program currently utilizes several distinct monitoring protocols, including systematic landscape-level aerial reconnaissance, a sample-based spatially stratified monitoring system, detailed inventories in planned control areas, and a set of methods focused solely on EDRR. In 2019, the SFWMD adopted the NPS “Everglades Corridors of Invasion” early detection monitoring protocol and expanded the monitoring program to state-managed lands within the WCAs and eastern Everglades.

**Monitoring for Animals:** The SFWMD and UF have established survey routes for new and emerging invasive exotic reptiles and amphibians within the Everglades Cooperative Invasive Species Management Area (ECISMA) footprint through the Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP). In addition to identifying new invaders, these routes help to identify and remove established species. To date, EDRR surveys and trapping have resulted in the removal of 101 Nile monitors, 2,178 Argentine black and white tegus, 601 Oustalet’s chameleons, 24 veiled chameleons, 140 spectacled caimans, 132 Burmese pythons, one Nile crocodile, and several other species.

Metagenomic surveys help detect a variety of species by identifying DNA present in south Florida waters. During the reporting period, the USDA completed a survey and the USGS has a survey that is ongoing. This research will be a useful tool in the field to determine species present in the waterways.

## Public Reporting

**Hotline and Web-Based Reporting:** The FWC Nonnative Fish and Wildlife Program uses sightings, many by the public, to determine if a new nonnative species may have the potential to reproduce and become established. The 888-IveGot1 hotline and associated smartphone app are instrumental in this regard. From June 1, 2018 – June 8, 2020, the average reporting per day was 5.7 calls with a total of 5,233. Reports from these sources led to the discovery of an emergent Argentine black and white tegu population in Charlotte County where over 100 tegus have been removed since June 2018. The Early Detection and Distribution Maps (EDDMapS) is a web-based mapping system for documenting invasive plant and wildlife species distribution. It tracks and verifies sightings from species professionals and members of the public. During the reporting period, EDDMapS had over 9,327 nonnative wildlife records.

**Targeted Outreach and Training:** The SFWMD and UF are conducting strategic training and outreach to promote citizen scientist involvement in reporting invasive animal sightings in the Everglades. Agency staff and public groups who are typically in wilderness areas are provided training on the “IveGot1” reporting program. ENP has improved early detection capacity through IES training for park interpretative staff, law enforcement, and maintenance staff, providing park-wide email IES updates, and publishing articles in the South Dade News Leader. These efforts have resulted in the reports and in some cases, removal, of invasive iguanas, agamas, and other species that are early in the invasion curve inside the park.

**Combining Education, Recreation, and Monitoring:** Nonnative fish roundups raise public awareness about the negative impacts of releasing invasive fish while also providing a snapshot of invasive exotic species in local waters. 2019 marked the 10<sup>th</sup> anniversary of the ECISMA Nonnative Fish Round Up. During this event, 19 distinct species and 679 pounds of nonnative fish were removed. The Southwest Cooperative Invasive Species Management Area CISMA 2019 event removed 3,755 invasive fish for a total of 2,012 pounds. Participants were encouraged to consumptively use their catch and the remainder was donated to a wildlife facility. Additional Fish Slams by FWC and USGS have been conducted with nearly 100 individuals from 20 organizations participating. To date, nearly 200 sites have been sampled and 36 nonnative species have been collected with range expansions documented for five of those species. For lionfish events, see Long-term Management.

## Rapid Response Teams and Activities

**Invasive Exotic Plant Rapid Response:** CISMAs help coordinate collaborative efforts to manage priority EDRR plant species in their regions. CISMAs within the Everglades footprint actively maintain EDRR plant lists specific to their region. Plants are typically categorized as priority for eradication (i.e., known invaders) or “be on the lookout” (i.e., probable risk for introduction). The Florida Natural Areas Inventory works with the CISMAs to maintain the lists. Additional CISMA efforts typically combine dedicated monitoring and control field days with stakeholder training (e.g. identification) and research to improve control tools. Two current examples of regional invasive plant eradication efforts are tropical nutrush in the Kissimmee River basin and Asian black mangrove in Miami-Dade County. Over the past 10 years, the same 20-acre Asian black mangrove infestation at Matheson Hammock and Fairchild Tropical Botanic Garden has been repeatedly treated. There were 400 plants removed in 2019 and 200 plants removed in the first half of 2020.

**Environmental Quality Incentives Program (EQIP):** EQIP, administered by USDA-NRCS, provides financial and technical assistance to agricultural producers to address natural resource concerns and deliver environmental benefits. Through EQIP contracts, USDA-NRCS assisted in the removal of invasive plant species, such as Brazilian pepper, cogongrass, and tropical soda apple, on 16,700 acres of private and tribal lands in south Florida during the reporting period.

**USFWS Invasive Species Strike Team (ISST):** The USFWS ISST controls and manages invasive exotic plants and animals in national wildlife refuges (NWRs). In FY 2019, \$1.259 million was awarded to NWRs in the Southeast Region for treatment of nonnative invasive plants and animals with Florida refuges receiving the bulk (75%) of the funding. The Loxahatchee National Wildlife Refuge (LNWR) received \$500,000 for management of invasive exotic plants. EDRR highlights for 2019 included treatment of the first recorded tropical soda apple plant in the southeast corner of LNWR and treatment of the second

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documented occurrence of a Schefflera tree in the marsh interior. The ISST also supported a UF spectacled caiman survey and removal project to address incipient caiman infestations in the C-111 Spreader Canal Western Project Basin that threaten nearby ENP.

**Invasive Exotic Animal Rapid Response:** During the reporting period, rapid response teams removed high priority nonnative wildlife species that are not yet breeding in Florida. These species include a Warthog, a Dumeril's boa, multiple ball pythons, 4 red-tailed boa constrictors, 2 Chinese water dragons, and several species of monitor including 4 water monitors, 2 Savannah monitors, and a black-throated monitor, as well as conditional or injurious constrictors like the yellow anaconda. The FWC and partners also continued rapid response efforts to contain the spread and reduce the likelihood of incipient population establishment of several high priority species that are detrimental to Florida's ecology. Details on these efforts can be found under Containment (tegas and Nile monitors) and Long-term Management (pythons).

The FWC's Nonnative Wildlife Responder Network consists of volunteers who have taken FWC training on how to identify, survey for, trap, safe capture, or assist with other rapid response scenarios across the state for high priority invasive wildlife. During this reporting period there were a total of 81 active volunteers, 34 volunteer partner responders, and 47 other non-FWC volunteer responders.

## CONTAINMENT

Once it is determined that eradication of an invasive exotic species is not possible, containment efforts focus on preventing the spread of the species to new areas to minimize the damage to the ecosystem and reduce long-term control costs. The containment phase focuses on the utilization and often rapid deployment of control tools at containment boundaries and known pathways.

### Containment of Invasive Exotic Animals

During the reporting period, partners increased coordination efforts and resources to control expanding populations of several invasive animal species. The Argentine black and white tegu is an invasive reptile established in multiple counties in Florida including Miami-Dade where a growing and spreading tegu population is a threat to native wildlife such as crocodiles, sea turtles, ground-nesting birds, and small mammals. The FWC, UF, SFWMD, NPS, FPL, and USGS are all contributing to trapping and monitoring for tegus in southern Miami-Dade County. During the reporting period, almost 1,500 tegus were removed from this area. Despite increases in management, research, and coordination efforts, the southern Miami-Dade County tegu population continues to expand and is now at the ENP boundary. At least 8 tegus were trapped just inside the park in 2020, and though there is no evidence that tegus are reproducing in the park, there is evidence of reproduction just outside the park. To help optimize trapping efforts in this area, UF is beginning to model trapping data to provide managers information on tegu abundance, population dynamics, and effectiveness of management efforts.

The FWC continues to conduct systematic removal of other high priority nonnative species across south Florida, including Nile monitors. Nile monitors are present near the LNWR and efforts to contain them out of the refuge are underway to protect native aquatic species from predation. Between July 1, 2018 – June 9, 2020, the FWC and partners removed 8 Nile monitors from the nearby breeding population in Palm Beach County. One Nile monitor removed in spring 2020 had 30 developing eggs in its reproductive tract.

### Containment of Invasive Exotic Plants

The FWC, SFWMD, and other agencies continued efforts to contain and control several invasive plant species that have limited but expanding populations in the Everglades region. Several of these species were identified in the last reporting period, including mission grass in central Palm Beach County and feathered mosquito fern in canals of the Northern Everglades. Additionally, the FWC continued efforts in controlling the occurrence and expansion of para grass and West Indian marsh grass in WCA-3A and Wright's nutrush in WCA-3A and the Holey Land Wildlife Management Area.

## RESOURCE PROTECTION AND LONG-TERM MANAGEMENT

The final stage of the Invasion Curve is resource protection and long-term management. This phase endeavors to reduce the ecological and financial impact of wide-spread invasive exotic species so they no longer play a dominant role in the ecosystem. This can be accomplished by developing and using control tools to reduce the population densities of a species within a specific area and by strengthening the resilience of natural areas through restoration of native habitats and recovery of ecosystem functions.

### Long-term Maintenance of Invasive Exotic Animals

**Amphibians and Reptiles:** According to the USFWS, Florida ranks as having the largest number of established non-indigenous amphibians and reptile species in the entire world. Fifty-six non-native amphibians and reptiles have established themselves in Florida, including three frogs, four turtles, one crocodylian, forty-three lizards, and five snakes. Burmese pythons are a threat to native wildlife and ecosystems of south Florida, including several threatened and endangered species, and their presence has led to severe declines in Everglades mammal populations. Other species of nonnative constrictors would likely have similar impacts as Burmese pythons if they were to grow in number in south Florida. For example, due to the rapid response of interagency invasive species teams, Northern African pythons have not invaded south Florida beyond a small area west of Miami.

The State of Florida's Python Removal Contractor Program hires experienced local experts who are compensated for survey time and removal of pythons from public lands. In 2020, the SFWMD and FWC expanded the program to 100 total contractors. During the reporting period, this program has removed almost 1,061 pythons and over 150 python eggs from south Florida. ENP also increased the number of authorized agents allowed in their Python Removal Authorized Agent Program from 130 to 250 individuals. Together, these contractor programs now include most state managed lands, ENP, BNP, and Big Cypress National Preserve. The FWC's Python Pickup program allows python removal from any property where the individual has authorization to work.

FWC has hosted three Python Challenge events where registered participants removed pythons from public lands for a chance to win prizes. The 2020 event was cohosted with the SFWMD and called the Python Bowl in relation to the Superbowl being held in Miami. More than 750 people from 20 states participated in the 10-day competition that resulted in 80 pythons being removed.

[www.flpythonchallenge.org](http://www.flpythonchallenge.org)

Coordination efforts to control pythons continue to be improved. A broad interagency group is developing a statewide, Interagency Python Management Plan. This plan will improve coordination of python management efforts across jurisdictions and prioritization of across agency research needs. Additionally, the USGS, NPS, USFWS, and Conservancy of Southwest Florida are partnering together to radio-track Burmese pythons in Big Cypress National Preserve, Crocodile Lake National Wildlife Refuge, and other areas of southwest Florida. This new partnership marks the first time that pythons will be tracked in such a broad variety of habitats. This effort will improve understanding of python biology across the region and ultimately find ways to more effectively control this invasive species.

The USGS is applying existing Burmese python eDNA method in systematic surveys of south Florida waterways to monitor possible range expansions. The presence of Burmese python eDNA in the LNWR has been confirmed since 2016. Additional samples are being assessed to the north and west of the refuge and more comprehensive information will be available on any expansion in the near future.

**Marine Species:** Lionfish, a popular aquarium fish native to the Indo-Pacific, can now be found from Venezuela to North Carolina. Lionfish have few predators and represent a threat to native fish species, many of which have economic importance (sportfishing) or ecological importance for the health of Florida's Coral Reef. The FWC has prohibited the importation of live lionfish into Florida, intentional breeding of lionfish in captivity in Florida, and harvest or possession of lionfish eggs or larvae in Florida for any purpose

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other than destruction. However, their range continues to expand, having recently been found in the brackish waters of the Loxahatchee River, St. Lucie River, some inland canals, the Florida Intracoastal waterway, and Florida Bay within ENP.

NPS' long-term management efforts for lionfish, having been sustained at appreciable levels for the past 10 years, have helped identify areas frequented by lionfish for targeted removal efforts and aided in the development of best available tools for removal. From July 1, 2019 - June 30, 2020, a total of 988 lionfish were removed from BNP. These 988 lionfish were removed during 144 separate dives over 35 field days, with one lionfish being removed, on average, every 20 minutes of diver effort. BNP staff successfully removed ~88% of sighted lionfish.

Multiple agencies, including USGS, NPS, and FWC, have citizen science programs to report lionfish sightings. These sightings have helped scientists map the lionfish invasion and have identified targeted removal study hotspots. FWC has also engaged the public with lionfish events and outreach meant to inform the public of ways to help slow down the lionfish invasion. The State of Florida does not have minimum size limits, closed seasons, or bag limits for recreational or commercial harvest of lionfish. Recreational derbies have been successful in removing over 100,000 lionfish from 2018-2020, while commercial harvest during this same timeframe has removed over 100,000 pounds of lionfish.

In collaboration with FWC and other state and federal agencies, NOAA Fisheries completed a programmatic environmental assessment on lionfish trap use in the Gulf of Mexico and South Atlantic, including within FKNMS. NOAA Fisheries and NOAA's Office of Marine Sanctuaries (ONMS) have issued Exempted Fishing Permits and Sanctuary permits for lionfish trap testing studies. NOAA Fisheries has also issued multiple Letters of Acknowledgement for lionfish research and is currently updating the federal list of allowable gear for lionfish harvest. NOAA ONMS is also issuing permits to allow spears in Sanctuary no fishing zones to specifically harvest lionfish.

During the reporting period, NOAA and USGS raised awareness of a relatively new invasive species causing concern in marine areas, including Biscayne Bay: the Asian tiger shrimp. Although not yet determined to be established, sightings have "notably increased" in recent years. Tiger shrimp are aggressive predators and can inhabit waters ranging in salinity from 2 to 35 ppt. This range in salinity tolerance is broader than that of the native pink shrimp, therefore tiger shrimp may be able to outcompete native pink shrimp in the lower salinity conditions anticipated in Biscayne Bay with CERP implementation.

### **Long-term Maintenance of Invasive Exotic Plants**

The status of invasive plant management in the Everglades remains a mix of successes and continued challenges during the reporting period. Past efforts relied on land managers requesting funds for invasive plant management on individual sites, with the amount of money received determining what could be accomplished in a given year. This minimal, often non-recurring, funding model did not result in cost-effective or sustainable success. In the recent past, federal management funding continually decreased. State funding fluctuated, but to a lesser degree. Sustained funding, even when insufficient, allows development of a long-term treatment strategy. For large public conservation lands where infestations are significant, landscape level planning and continuous funding are paramount. One method to overcome the lack of sufficient recurring funds is to form cost-and resource-sharing cooperative agreements between land managing agencies. Such agreements can include the sharing of personnel, equipment, chemicals, biocontrol agents, computer technology, inventory and monitoring data, and educational materials. Cooperators also share the knowledge and skills of available experts and technicians, sponsor joint training, and convene technical workshops and informational meetings. Successful cooperative agreements also help to reduce parochial conflicts and institutional barriers that limit the most efficient use of public management resources.

In south Florida, federal, state, and regional agencies do cooperate and combine resources. The FWC, SFWMD, USFWS, NPS, Florida Forest Service, and Florida Park Service have collaborated on operational management and funding of single and connected conservation lands. This collaboration has resulted in

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millions of acres of initial and maintenance control of invasive plant species. The FWC continues to receive funding to treat invasive plant species in 57 waterbodies (636,280 acres) and 849 public conservation lands (5,943,751 acres) within the CERP footprint.

**Priority Species:** Eighty species of invasive exotic plant species are considered priorities for control by natural resource managers in south Florida. Interagency efforts to achieve maintenance control of invasive plants continue. Old World climbing fern, melaleuca, and Brazilian pepper continue to be system-wide priorities, while aquatic plants such as hydrilla and water hyacinth are priorities in the Kissimmee Basin and Lake Okeechobee. Melaleuca, which once impacted large areas of the greater Everglades, is now considered to be at maintenance control levels in WCA 2 and 3. The USFWS, FWC, and the SFWMD are actively engaged in aggressive control efforts in the LNWR where melaleuca and Old World climbing fern are not yet considered in maintenance control levels.

**Biological Controls:** The USDA-ARS, in collaboration with USACE and SFWMD, are strategically releasing agents for the suppression of Old World climbing fern, Brazilian pepper, and water hyacinth. During July 1, 2018 – June 30, 2020, the USDA-ARS released two new biological control agents for the invasive Brazilian pepper tree.

**Herbicide Controls:** There is a need for a full, functional toolbox to deal with invasive exotic plants including the use of herbicides. Human health concerns regarding glyphosate have resulted in some local governments within the South Florida Ecosystem banning the use of this herbicide. Public land managers have expressed concerns that banning or restricting the use of glyphosate may result in the further spread of invasive plants in natural areas.

The issue of glyphosate restrictions was discussed at Task Force and Working Group/SCG meetings during the reporting period. The continued use of glyphosate for invasive plants in natural areas has been identified within the 2020 IES Strategic Action Framework as a priority need/gap. Additionally, in 2019, the USFWS signed a letter of support for FWC regarding their continued use of herbicides in the treatment of aquatic plants within the Kissimmee Chain of Lakes, Lake Okeechobee, and other areas. The FWC is undertaking a Lake Okeechobee Fish, Wildlife, and Habitat Management Plan that will address many of the issues regarding glyphosate use on aquatic plants. In January 2020, the USEPA concluded a review of all scientific data available for glyphosate registration and did not find anything that would change its status as an approved and registered herbicide. The FWC continues to use this product safely in its management programs.

# WATER MANAGEMENT

CERP is expected to improve the timing, volume, and distribution of water throughout the system primarily by increasing regional storage capacity, removing barriers to flow, and carefully redistributing water within the system to more closely match natural cycles. The increase in regional storage capacity provided by the CERP is also expected to increase water resource benefits for other water-related needs of the region that includes water supply and flood protection as well as recreational and navigation opportunities and protection of cultural and archeological resources and values.

Operational modifications and new infrastructure will store water for both the environment and developed areas. WRDA2000 established CERP protections that reserved water specifically identified for ecosystem restoration and preserved the levels of service for flood protection and water supply that were in existence on December 11, 2000, the date that the law was enacted and in accordance with applicable law.

Land suitable for development and human habitation will continue to require considerable flood protection, as without such protection most of south Florida would be unsuitable for existing urban and agricultural uses. Given the population growth projections for south Florida, there will be an ongoing need for monitoring and balancing the flood protection needs of urban, natural, and agricultural lands as part of restoration.

## FLOOD PROTECTION

**C-4 Flood Mitigation Project:** The C-4 Flood Mitigation Project includes multiple individual projects to provide flood mitigation in the C-4 Basin. These include impoundments, pump stations, flood walls, and berms as well as conveyance improvements. Two forward pumps (S-25B and S-26) and seven segments of canal bank improvement projects have been completed with the final segment being completed during the reporting period.

**Hillsboro Canal Bank Stabilization Project:** The Hillsboro Canal is a primary flood control feature serving southern Palm Beach County and northern Broward County. Construction is complete on the first two phases of the Hillsboro Canal Bank Stabilization Project. The project replaced collapsing banks on both the north and south sides with properly sloped, armored, and vegetated banks and removed sediment from the canal that resulted from the collapsing material. This returned the canal to its full hydraulic capacity. The first two phases covered 7.5 miles of canal from the southeast corner of Site 1 eastward to the G-56 coastal structure. During the reporting period, the design was completed for the last phase, which will repair the remaining westernmost 3 miles of the canal.

**J.W. Corbett Wildlife Management Area Levee:** In August 2014, the FDEP issued a permit for the construction of a new 6.25-mile levee system to increase flood protection for south Florida residents. This project is located within the J.W. Corbett Wildlife Management Area located in western Palm Beach County. The levee system improvement project consists of constructing a new levee within uplands and wetlands in areas which separate J.W. Corbett from the Indian Trail Improvement District's M-O Canal. This project is a cooperative effort between the SFWMD, the FWC, and the Indian Trail Improvement District. The SFWMD has completed the first phase of the project and the second phase is awaiting funding for construction. The project (phase 1) has been completed to the satisfaction of FDEP.

**Herbert Hoover Dike (HHD):** Lake Okeechobee is a 730-square mile lake that is surrounded by the 143-mile long HHD. The dike is currently being rehabilitated due to safety concerns. During the reporting period the USACE continued work on 32 federal water control structures, also known as culverts, which are considered to be the greatest threat to the dike due to loss of material into and around them. The USACE has taken action on all 32 of the culverts: one was removed, three abandoned, seventeen were replaced, and eleven are under contract for replacement. Work on all culverts is scheduled to be complete by 2022.

During the reporting period, construction was completed to close the gaps in the 21.4 miles of the Reach 1 cutoff wall from Port Mayaca to Belle Glade. Construction on the 6.6-mile extension of the cutoff wall from

Belle Glade to Lake Harbor is ongoing. The Dam Modification Cutoff Wall Multiple Award Task Order Contract was awarded to three contractors in January 2019. Four task order contracts including 24.4 miles of cutoff wall construction have been awarded through January 2020 with the final 4.1-mile task order was awarded on April 30, 2020. The three embankment armoring contracts are all scheduled to be awarded in 2020 with completion of all HHD construction contracts by 2022. The State of Florida contributed \$100 million to help accelerate completion from 2025 to 2022. USACE allocated \$514 million in Supplemental Long-Term Disaster Recovery Investment Plan funds and \$162.4 million in FY 2019 for HHD rehabilitation acceleration. The total cost of the rehabilitation program is approximately \$1.8 billion.

## WATER SUPPLY PLANNING

The SFWMD conducts water supply planning for five regions: Upper Kissimmee Basin, Lower Kissimmee Basin, Upper East Coast, Lower East Coast, and Lower West Coast. These long-range plans project water demands for at least a 20-year period and identify potential sources of water for each region and help local governments and utilities in their facility and comprehensive planning efforts. Water supply plans are updated every five years.

**Central Florida Water Initiative (CFWI)/Upper Kissimmee Basin:** Three water management districts (South Florida, Southwest Florida, and St. Johns River), along with the FDEP, the FDACS, regional public water supply utilities, and other stakeholders, are working collaboratively to develop an update to the water supply plan for central Florida as part of the CFWI. The planning area includes southern Lake, Orange, Osceola, Seminole, and Polk counties. The 5-year update is well underway and is scheduled to be completed in November 2020 with demand projections out to 2040.

<https://www.cfwewater.com/planning.html>

**Lower Kissimmee Basin:** The Lower Kissimmee Basin Water Supply Planning area includes portions of Okeechobee, Highlands, and Glades counties. The plan assesses water needs and water sources for the period from 2017 to 2040, was updated during the reporting period, and approved by the Governing Board in December 2019.

**Upper East Coast (UEC):** The UEC Water Supply Planning area includes Martin and St. Lucie counties, as well as the northeast portion of Okeechobee County. The 2016 UEC Plan assessed estimated and projected water demands and potential sources for the period from 2013 to 2040. The 5-year update to this plan has been initiated, will assess water demand projections through 2045, and is scheduled to be completed by the end of 2021.

**Lower East Coast (LEC):** The LEC Water Supply Planning area includes Palm Beach, Broward, and Miami-Dade counties and parts of Monroe, Collier, and Hendry counties. The 2018 LEC Water Supply Plan Update was approved by the Governing Board in November 2018 and assessed estimated and projected water demands and potential sources of water for the period from 2016 to 2040.

**Lower West Coast (LWC):** The LWC Water Supply Planning area includes Lee County and portions of Charlotte, Collier, Glades, Hendry and Monroe counties. A 2019 amendment to Appendix C of the 2017 LWC was approved in December 2019. The amendment was limited in scope and does not constitute an update of the 2017 plan.

## WATER CONSERVATION

**Comprehensive Water Conservation Program:** The SFWMD continues to implement water conservation programs to promote the efficient use of water in all use sectors and encourage a permanent conservation ethic throughout our 16-county region. The average per capita water use rate for utilities is trending downward as reported in the SFWMD's water supply plans.

## ALTERNATIVE WATER SUPPLY

**Reuse:** In 2019, a total of 109 treatment facilities provided reclaimed water for beneficial purposes within the SFWMD. These facilities reused a total of 302 million gallons per day (mgd) of treated wastewater. Most of the reclaimed water (190 mgd) was used for landscape irrigation at over 156,648 residences, 193 golf courses, 333 parks, and 81 schools.

The FDEP maintains a large and comprehensive database of permitted reuse systems. Domestic wastewater treatment facilities (0.1 mgd and greater) that provide reclaimed water are required to submit annual reuse reports to the FDEP as well as the applicable water management district. These annual reports are the basis for the FDEP's reuse inventory database, from which a Reuse Inventory Report is compiled and published.

<https://floridadep.gov/water/domestic-wastewater/content/water-reuse-program>

In 2019, the State of Florida committed \$40 million to fund an alternative water supply grant program with each of the water management districts. This grant program resulted in funding 20 projects that, when completed, will provide more than 60 mgd additional water. The south Florida region alone stands to gain more than 12 mgd from the \$15.5 million provided for these critical projects. While beyond the scope of this reporting period, on July 1, 2020, the State of Florida continued this commitment by appropriating an additional \$40 million.

**Wastewater Ocean Outfall Discharges:** In 2008, the Florida Legislature passed a law requiring wastewater effluent discharges through ocean outfalls to cease by December 31, 2025, except as "backup discharge" to a functioning reuse system. In addition, the law requires that those utilities implement 60 percent reuse of the effluent being discharged to the ocean which equates to an additional 165 mgd of reuse by the 2025 deadline.

**Alternative Water Supply Program:** Between FY 2018-20, \$10,756,600 in SFWMD and State funding was allocated for 10 projects. Approximately 516 mgd of water has been made available by 515 projects. In addition, there are 40 operational desalination facilities with a total capacity of approximately 287 mgd (all but two utilize brackish groundwater as source water) within the SFWMD boundary.

## PROTECTING WATER RESOURCES

Several mechanisms exist to protect water resources for the natural system. These mechanisms include minimum flows and levels (MFLs), water reservations, and allocations. The WRDA 2000 requires that the State of Florida reserve or allocate water for the natural systems associated with implementation of the CERP. Once MFLs, water reservations, or restricted allocation areas rules are adopted, they are implemented through the SFWMD's consumptive use permitting and water supply planning programs. The current list can be found on the listed on the SFWMD's Priority Water Body List and Schedule.

**Minimum Flows and Levels:** Florida law directs the SFWMD to set MFLs to prevent significant harm to water resources. Since 2001, MFLs and recovery and prevention strategies have been adopted for waterbodies covering approximately 7.2 million acres. There are currently nine MFL waterbodies within the SFWMD boundary. During the reporting period, the SFWMD conducted additional analyses and adopted amended MFL criteria for the Caloosahatchee River on October 10, 2019. <https://www.sfwmd.gov/our-work/mfl>

**Water Reservations and Allocations:** Water reservations set water aside from consumptive use permitting for the protection of fish and wildlife or public health and safety. The SFWMD is currently in the rule development process to establish a water reservation for the Kissimmee River Basin, which includes the Kissimmee Chain of Lakes (19 lakes total), the Kissimmee River, and its floodplain. Construction for the Kissimmee River Restoration Project is expected to be completed in 2021. This water reservation will protect from allocation water that is needed to ensure protection of the public investment of approximately \$800 million for restoration of the Kissimmee River. Adoption of this water reservation rule is scheduled to be completed in December 2020. Additionally, the SFWMD is developing a new reservation for the EAA

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Reservoir STA, scheduled to be completed by 2022. <https://www.sfwmd.gov/our-work/water-reservations>

**Restricted Allocation Area (RAAs):** RAA criteria are established by rule to protect natural systems from consumptive use impacts. These rules are implemented where there is a lack of water available to meet the projected needs of a region. RAA rules help ensure that water will be available when future CERP projects are completed. RAA rules have been adopted to protect natural system water for the Loxahatchee River and the Everglades. These types of rules have also been adopted for other MFL waterbodies.

# LOOKING AHEAD

## INTEGRATED DELIVERY SCHEDULE (IDS)

The IDS helps restoration planners, stakeholders, and the public focus on priorities, opportunities, and challenges and provides a path forward to complete construction on previously authorized projects while outlining the next projects to undergo planning and design. The IDS synchronizes program and project priorities with the State of Florida and achieves the CERP restoration objectives at the earliest practicable time, consistent with funding constraints and the interdependencies between project components. The IDS is a living document that is updated as needed to reflect progress and/or program changes. During the reporting period, the July 2018 IDS was updated utilizing the Task Force's successful public workshop model to engage the public and stakeholders and enable meaningful input towards identifying priorities for completing construction of projects underway as well as priorities for the next phase of CERP planning.

The October 2019 IDS reflected changes to the scheduling of the projects based upon notional budgets for FY 2020 and beyond. However, the IDS does not represent a commitment by the federal or state government to include amounts reflected on the IDS in the federal or state budget. The theme of the 2019 update was building on historic momentum and highlighting Everglades science as the key to delivering CERP Goals. Unlike previous years, CEPP was broken out into an additional table to highlight CEPP South, North, and New Water components. Included in the 2019 update are current restoration planning efforts (such as the LRWRP, WERP, and the LOWRP), as well as future restoration planning efforts such as the C-111 Spreader Canal Eastern project and the BBSEER. An updated 2020 IDS will be released by the end of December 2020. An alternative scenario exercise undertaken for the October 2019 IDS is described in the Task Force/OERI section of this document.

# THE ROLE OF SCIENCE

## SCIENCE IN PLANNING AND EVALUATING RESTORATION SUCCESS

The Task Force sponsors a biennial System-wide Ecological Indicators (SEI) report and the Corps and the SFWMD sponsor a five-year System Status Report (SSR) through the interagency REStoration, COOrdination and VERification (RECOVER) program to track the health of the Everglades ecosystem. Both reports evaluate environmental monitoring information to determine if the goals and objectives of Everglades restoration are being met. The SEI report focuses on a broader range of restoration actions using eleven system-wide ecological indicators, while the SSR focuses on the CERP using a larger set of indicators. Both reports build from the RECOVER Monitoring and Assessment Plan (MAP). The goal of the MAP is to document the status and trends of the essential and defining attributes of the South Florida Ecosystem. These reports document how the hydrology and ecology of the Everglades respond to restoration, project implementation, and water management operations. This scientific information is fed into the decision-making process, allowing managers and decision makers to use the best available science and adaptive management principles to track and guide restoration success.

In 2019, the RECOVER team produced the 2019 SSR and an Everglades Report Card. Ecological report cards have been successfully used in other restoration programs to clearly communicate ecosystem health to a geographically broad constituency. The Everglades Report Card revolves around the four MAP modules – the Northern Estuaries, Lake Okeechobee, Greater Everglades, and Southern Coastal Systems – and the indicator species that are unique to each. A second 2019 RECOVER effort, identified in the RECOVER Five Year Plan, is a vulnerability analysis that will identify geographic areas and ecological components or processes that are most vulnerable to stress, and the ability of current or future restoration actions to mitigate or minimize this vulnerability. Identifying and diagnosing the most vulnerable locations, species, and ecological components or functions in the Everglades will help us focus our actions and prioritize our most crucial vulnerabilities.

## HOW WE USE SCIENCE TO PLAN

High-quality science is the foundation for the successful restoration of the Everglades. Monitoring, research, and modeling provide management-relevant information that is used for selecting restoration alternatives and making natural resource management decisions. Continuing application of science is occurring in the Restoration Strategies project, the WCA-3 Decompartmentalization Physical Model, CERP planning efforts, and the ongoing effort to examine the impacts of nonnative plants and animals and to find ways to lessen their impacts and prevent future invasions. For example, the USGS Greater Everglades Priority Ecosystem Sciences (GEPES) Program and other USGS sources are investing about \$2 million per year in scientific research related to determining the impacts of, and how to control the invasive Burmese python. Science describing the ecological importance of restoring water quantity and flows to the Everglades was pivotal in the decision to build bridging on Tamiami Trail to remove barriers to flow. Science topics will evolve as restoration planning and implementation proceed, but are likely to include an increasing emphasis on topics such as: fostering the compatibility of built and natural systems; the long-term impacts of hurricanes and other tropical storms and their interaction with restoration efforts; the benefits of CERP, Restoration Strategies, and Tamiami Trail Next Steps; and the causative factors leading to harmful algal blooms in Lake Okeechobee and the estuaries. Florida Atlantic University's Center for Environmental Studies, with funding from and in partnership with the GEPES Program, created a series of free, online educational videos about harmful algal blooms intended primarily for natural resource managers, but available to anyone (<http://www.ces.fau.edu/usgs/understanding-algae/>). Also, the USGS, USACE, and others are conducting scientific research to better understand the factors that lead to harmful algal blooms.

# TASK FORCE & OFFICE OF EVERGLADES RESTORATION INITIATIVES (OERI)

The intergovernmental Task Force is the only forum that provides strategic coordination and a system-wide perspective to guide the separate restoration efforts being planned and implemented in south Florida.

The duties of the Task Force are to:

- Coordinate the development of consistent policies, strategies, plans, programs, projects, activities, and priorities for addressing the restoration, preservation, and protection of the South Florida Ecosystem;
- Exchange information regarding programs, projects, and activities of the agencies and entities represented on the Task Force to promote ecosystem restoration and maintenance;
- Facilitate the resolution of interagency and intergovernmental conflicts associated with the restoration of the South Florida Ecosystem among the agencies and entities represented on the Task Force;
- Coordinate scientific and other research associated with the restoration of the South Florida Ecosystem; and
- Provide assistance and support to agencies and entities represented on the Task Force in their restoration activities.

The U.S. Department of the Interior's Office of Everglades Restoration Initiatives (OERI) leadership and staff will continue to support and work directly with the federal, state, local government, and tribal representatives on the Task Force. OERI will also administer, manage, and support the priorities, activities, meetings, and the required reporting responsibilities of the Task Force, its Working Group, the Science Coordination Group, and any designated advisory bodies. The OERI on behalf of the Task Force will produce congressionally mandated reporting documents. These documents include the South Florida Ecosystem Restoration Strategy, the Biennial Report, the Integrated Financial Plan, and the Cross-Cut Budget. OERI will also collaborate with the USACE in preparation of the 2020 Five Year CERP Report to Congress. In addition to the required Everglades restoration support activities, the Task Force has assigned OERI to support and lead its efforts to: update their Invasive Exotic Species Strategic Action Framework, update the 2015 Invasive Exotics Crosscut Budget document; update and assess the System-wide Ecological Indicators Report which is an integral component of the Task Force's Biennial Report; and to analyze and develop alternative funding scenarios for the USACE's Integrated Delivery Schedule.

The Task Force met four times during the reporting period (July 2018, April 2019, October 2019 and May 2020). During the reporting period, the Working Group and SCG conducted six joint meetings on Everglades restoration activities. As part of its response to COVID-19, the May 2020 Task Force meeting and the June 2020 Joint Working Group/SCG meeting were successfully held using the Zoom Webinar platform. For those who were unable to join via the Zoom Webinar, there was also a live webcast of the meeting via the [EvergladesRestoration.gov](http://EvergladesRestoration.gov) website. The Biscayne Bay Regional Restoration Coordination Team (BBRRCT) continues to meet monthly to coordinate on restoration and science activities in Biscayne Bay.

## Organization

Four sovereign entities (federal, state, and two tribes) are represented on the Task Force. Fourteen members sit on the Task Force itself, representing seven federal departments, three state agencies/offices, two American Indian tribes, and two local governments.

The Florida-based Working Group and the Science Coordination Group (SCG) have been established to

assist the Task Force with its responsibilities. Their members include additional federal, state, and local agencies. The Task Force and Working Group establish regional and issue-based teams as needed to address pressing or area-based restoration concerns. The OERI supports and implements all Task Force, Working Group, Science Coordination Group, and team efforts.

## PARTNERSHIPS & ACTIVITIES

### Intergovernmental Coordination

The Task Force and its subgroups with the support of the OERI, conduct meetings for the purpose of intergovernmental coordination. The Task Force meets regularly to report on progress, facilitate consensus, and identify opportunities for improvement. The Task Force includes public participation in all its coordination activities

### Invasive Exotic Species

Recognizing the importance of protecting valuable resources by managing the growing threats of these and other invasive exotic species (IES), the Task Force developed an Invasive Exotic Species Strategic Action Framework (Framework) in 2015. This effort brought together IES experts from federal, state, tribal, and local governments and established consensus goals, objectives, and priorities.

During the reporting period, the Framework was identified as a priority by the WG and SCG and the Task Force concurred at their April 26, 2019 meeting. In response, the OERI conducted a series of teleconferences, in-person meetings, and web-conferences with its team of IES agency partners and experts during late 2019 and early 2020. As part of its response to the COVID-19 situation, the OERI also successfully utilized the Microsoft Teams platform to provide timely information and seamlessly update documents with IES team members. The 2020 Framework will include an updated base document, assessment of progress made since 2015, updated priorities, new program-level case studies, and an interagency “Snapshot Budget” for Invasive Exotic Species. The case studies are included in Appendix B. The 2020 Framework and associated documents will be available on [EvergladesRestoration.gov](http://EvergladesRestoration.gov).

### Alternative Scenarios for the Integrated Delivery Schedule

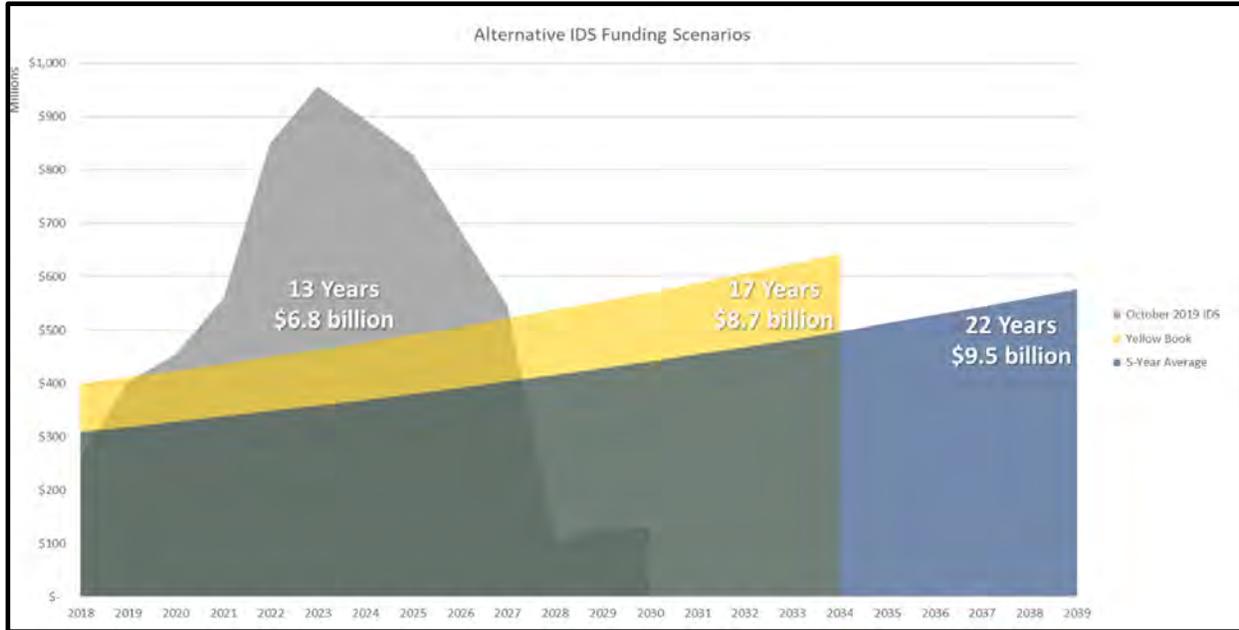
At their October 29, 2019 meeting, the Task Force discussed having different funding scenarios available for the IDS. The WG/SCG conducted a workshop session at their December 4, 2019 meeting to discuss potential funding scenarios and further refined the concepts at their February 25, 2020 meeting. OERI, USACE, FDEP, and SFWMD staff worked together to refine the scenarios. The analysis did not look at the intricate project sequencing and scheduling decisions that would need to be made for these hypothetical scenarios. It also did not anticipate future construction timelines or costs for projects currently in the planning phase. However, it does provide a generalized review of the impact of three different funding scenarios on the overall timelines and cumulative costs for the slate of activities depicted on the October 2019 IDS.

Three alternative scenarios were developed: 1) annual costs and project timelines as depicted on the October 2019 IDS, 2) funding levels at the \$400M/year as envisioned in CERP’s “Yellow Book,” and 3) a five-year average funding level that was developed from the past five years (this equated to approximately \$310M/year). The analysis included 3% annual increases in construction costs for the latter two scenarios.

In the October 2019 IDS, projects currently under construction are anticipated to be completed by 2030, if annual funding matches the planning estimates. If funding is received at the levels anticipated in the Yellow Book, that timeline roughly extends to 2034. If the five-year average of funding continues, the timeline extends to approximately 2039. The total dollars represented in the latter two scenarios also increase as the timelines are extended. The October 2019 IDS indicated an overall cost of \$6.8 billion. The Yellow Book scenario increased that estimate to \$8.7 billion and the five-year average increased it to \$9.5 billion.

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Simply stated, the main takeaway from this exercise, as presented to the Task Force at their May 7, 2020 meeting, was that if the annual funding requirements as estimated on the October 2019 IDS are not realized, the implementation of the current suite of projects on the 2019 IDS will take longer and cost more dollars to complete.



### NOTES:

- The graph includes design and construction costs for projects currently underway and planning costs for projects in the planning phase as listed on the October 2019 IDS.
- If the annual cost estimates are fully funded, projects currently in design/construction will be completed by 2030. However, more projects will break ground in the coming years. Once authorized, the design and construction of the IDS-listed planning projects will increase annual cost estimates and extend the timeline beyond FY2030.
- The funding shown for the October 2019 IDS (gray portion of the graph) is only notional, representing approximate funding levels that would be needed to sustain the work displayed in the IDS for any particular fiscal year. The funding does not represent a commitment by the Administration to budget the amounts shown.
- Non-CERP and Foundation Projects on the 2019 IDS that are funded by other program authorities or by other entities are not included on this graph or listed in the table.

## STAKEHOLDER ENGAGEMENT

**Stakeholder Workshops:** During the reporting period, the OERI on behalf of the Task Force employed its stakeholder workshop process to enhance public engagement on the IDS. This workshop was requested by the USACE at the June 2019 Working Group/SCG meeting. The Working Group voted unanimously to provide the requested workshop support to the Corps and the Working Group Chair requested that the Task Force sponsor the workshop. The Task Force subsequently voted and approved holding a single workshop in September 2019 on the 2019 IDS update. The revised IDS was reviewed and finalized at the October 2019 Task Force meeting.

**EvergladesRestoration.gov:** OERI continues to maintain and update the evergladesrestoration.gov website. The information contained in this report as well as the report itself can be found here along with other reports produced by the Task Force. Additionally, information relative to the overall restoration effort, such as the status of the projects being implemented, the latest news on restoration, and announcements on upcoming events, can be found either on the website itself or through links shown on the website.

# Appendix A

## System-wide Ecological Indicators

**2020 BIENNIALREPORT**

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# System-wide Ecological Indicators

The South Florida Ecosystem Restoration Task Force has established a suite of 11 system-wide ecological indicators to assess current ecosystem health and provide a means to track system-wide ecosystem response to restoration. This suite of system-wide ecological indicators and the green-yellow-red “stoplight” graphics were developed as a communication tool to provide a big picture view of the ecosystem’s health and response to restoration.

The system-wide ecological indicators and stoplight illustrations provided herein represent a summary of broader and more detailed science assessments than available in companion reports, including the 2020 System-wide Ecological Indicators for Everglades Restoration, and the South Florida Water Management District’s (SFWMD) 2020 South Florida Environmental Report.

These system-wide ecological indicators were chosen for their collective ability to comprehensively reflect ecosystem response to restoration in terms of space and time (Table 1). For example, periphyton responds to change very rapidly at both small and large spatial scales, while crocodilians respond to changes at short, intermediate, and long temporal scales and intermediate and large spatial scales. As indicators, they cover different aspects of the ecosystem.

The process of choosing these indicators is well-documented. In a special issue of the scientific journal Ecological Indicators (Volume 9, Supplement 6, November 2009), we outlined how each indicator was developed. In previous biennial reports, we also described the process for selecting the indicators and an explanation of how the indicators relate to other factors being monitored.

**Table 1. System-wide Ecological Indicators**

- Invasive Exotic Plants
- Lake Okeechobee Nearshore Zone Submerged Aquatic Vegetation
- Eastern Oysters
- Crocodilians (American Alligators and Crocodiles)
- Fish & Macroinvertebrates
- Periphyton
- Wading Birds (White Ibis & Wood Stork)
- Southern Coastal Systems Phytoplankton Blooms
- Florida Bay Submersed Aquatic Vegetation
- Juvenile Pink Shrimp
- Wading Birds (Roseate Spoonbill)

The ecological indicator sections provided below are brief and describe only composite results for the previous reporting period (Water Year 2018), the intermediate reporting year (Water Year 2019) and the current reporting period (Water Year 2020). Readers looking for more detailed information on regional status and changes in these indicators will find it within the full report ([2020 System-Wide Ecological Indicators Report](#) available at [Evergladesrestoration.gov](http://Evergladesrestoration.gov)).

In response to feedback from the Working Group and Science Coordination Group, the information on the indicators is being provided in a more concise manner focusing on the following:

- Why is this indicator important/what does this indicator tell us about Everglades Restoration?
- How do we expect this indicator to respond to Everglades Restoration?
- Which projects need to be implemented (or which geographic areas need to be restored) to see changes to this indicator?
- Given the projects that have been implemented what changes would you expect to see now?
- What was the response of this indicator in this reporting period? (WY 2019 and WY 2020)?

## Key Points from System-wide Ecological Indicators

- The overall status of this suite of ecological indicators has shown minor improvements since the last reporting period, primarily because Everglades Restoration projects have not yet been fully implemented to provide benefits at the system-wide level.
- Based on responses observed at small spatial scales and as a result of naturally occurring periods of high rainfall, it is expected that the status of crocodilians, fish and macroinvertebrates, periphyton, and wading birds will improve as Everglades Restoration projects, such as Modified Water Deliveries, Tamiami Trail Next Steps, and the Central Everglades Planning Project, are fully implemented and operational. These projects will deliver more water to the central Everglades and south to Florida Bay.
- Although Submerged Aquatic Vegetation (SAV) and Eastern Oysters were negatively impacted by Hurricane Irma in 2017, both exhibited recovery to pre-Irma conditions by WY 2020. SAV recovery was aided by low water levels improving light penetration and encouraging reestablishment of SAV. Eastern Oyster recovery was attributed to post-hurricane improvements in water quality. Implementation of Everglades Restoration projects that will substantially improve conditions in Lake Okeechobee and the estuaries on both coasts of south Florida will result in additional improvements in SAV and oysters.

## Hydrologic Context for Water Years (WYs) 2019 and 2020

The following discussion provides a basic introduction to the south Florida water cycle and a basic description of conditions during the reporting period that includes WYs 2019 (May 1, 2018 to April 30, 2019) and 2020 (May 1, 2019 to April 30, 2020). A more detailed discussion of south Florida hydrology is available in the 2020 System-wide Ecological Indicators for Everglades Restoration report.

The Everglades has a unique hydrologic, or water cycle. Throughout most of the continental United States, water levels generally rise and fall in tune with the four seasons. There, water levels typically peak during the spring as snow melts and front-driven storms move through, and ebb in the fall at the end of the hot summer. In contrast, the water cycle of subtropical south Florida and the Everglades is fueled by only two seasons—wet and dry—leading to a reversal of the typical seasonal high and low water levels. Water levels in the Everglades peak in the fall at the end of the wet season, and ebb in the spring when large expanses of wetlands dry out, at the end of the dry season.

### Summer Wet Season

The wet season typically begins in mid to late May and is characterized by hot and humid weather, daily buildup of spectacular cloud formations and resultant heavy thunderstorms that are often localized and short in duration. Other larger systems—including early season storms enhanced by lingering springtime instability in the upper atmosphere, mid-latitude cyclones and tropical storms—periodically spike the Everglades with regionally expansive rains.

In response to these meteorological inputs, the Everglades becomes flooded with an ankle to waist-deep, slow-moving pool of water throughout summer and fall, leaving only the high-ground tree islands and hardwood hammocks above water. The term sheet flow is used to describe this shallow and spatially expansive wetland plain that, unlike a lake or bog, flows like a stream, only much more slowly, almost imperceptible to the human eye. Spanning from horizon to horizon, this sheet of water flows south through a maze of tree-island-dotted ridges and sinuous low-lying sloughs, giving rise to the name River of Grass coined by Marjory Stoneman Douglas in 1947.

### Winter Dry Season

As the weather turns milder in October, the regular buildup of afternoon thundershowers and tropical storms ends, ushering in the dry season in mid to late November. As the dry season ensues, water levels continue to drop without much additional rainfall and more land emerges. Water first recedes from the highest elevation pinelands and other tree islands. Drainage of the marl prairies follows next, leading to an eventual

retreat of water into the lowest-lying sloughs and marshes. The rate of recession may be slowed or even temporarily reversed by sporadic winter rains that are typically brought on by the descent of cold continental air masses from the north. Lower winter evaporation rates also hinder the rate of recession, though it rapidly picks up again in spring as daylight hours and air temperatures increase evaporation.

South Florida is generally considered a wet area by merit of its abundant average annual rainfall, a total of 52.7 inches in the SFMWD region, with a 70/30 percent wet/dry season split. Despite the often flooded wetland views, drought and wildfire play vital roles in maintaining the region's unique assemblage of flora and fauna. The ecological health of the Everglades is intimately tied to seasonal and interannual fluctuations of the water cycle. It is also significantly impacted by a combination of:

- Natural processes
  - Rainfall
  - Evaporation
  - Overland flow
  - Groundwater infiltration
- Climatic oscillations
  - El Niño/La Niña
  - Climate change
- Water management manipulation associated with operation of the Central and Southern Florida Project (C&SF) project and other drainage works for the purpose of:
  - Flood protection
  - Urban and agricultural water supply
  - Environmental protection

Each WY is different in the Everglades, and the hydrologic cycle is characterized by large inter-annual variation—in other words, seldom do we experience average years.

The previous two WYs illustrate this variation well and are summarized next.

# Monthly Rainfall in South Florida for Water Years 2019 and 2020

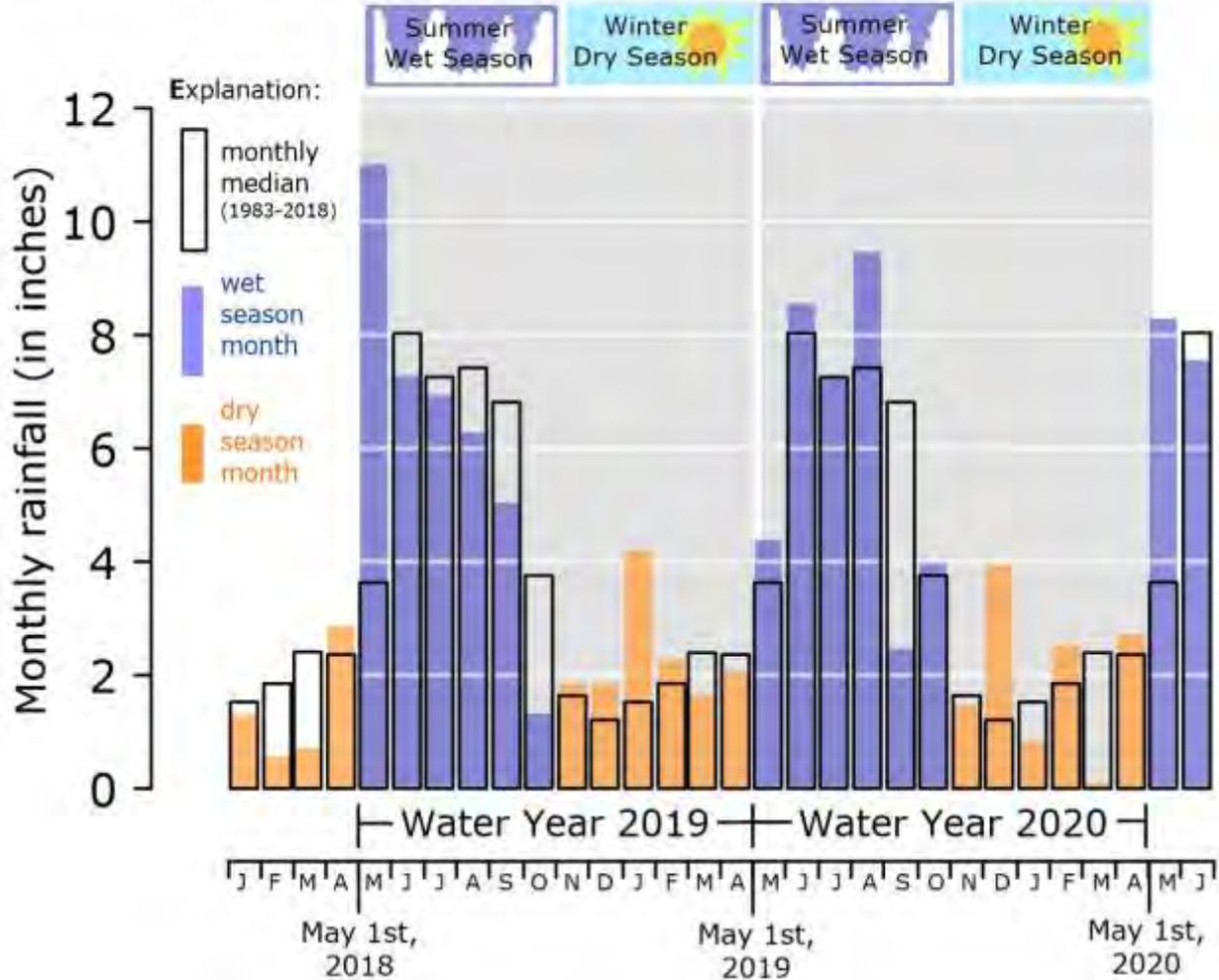


Figure 1. Summary of monthly rainfall in WY 2019 and WY 2020 throughout the South Florida Ecosystem. The graph was produced using daily rainfall data provided by the SFWMD. SFWMD meteorologists compute a daily rainfall value for the fourteen major basins and district-wide from rain gauge measurements. See <http://www.gohydrology.org/p/about.html> for more information.

## Water Year Summaries

### Water Year 2019 (May 1, 2018 to April 30, 2019)

WY 2019 started with prodigious rains in the May, the wet season’s opening month. Usually a time of transition when both the water table bottoms out and the regular pattern of afternoon thunderstorms begins - resulting in the gradual rise of the water through the Everglades and the Big Cypress Swamp - the triple dose of May’s usual rainfall allotment quickly jumped the water table up into the cypress and sawgrass plain. Initial expectations of a flood year resembling the Hurricane Irma fueled 2017 wet season failed to

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materialize as summer rains fizzled early, recording only six inches of combined rainfall in September and October compared to the normal 12 inches. The result was an early start to the dry season. Surface water had all but disappeared from the Big Cypress Swamp by January, setting the stage for a deep and prolonged dry season, when a series of storms flooded the cypress back to July levels.

WY 2019 exemplified the seasonally predictable, yet mercurial, nature of the south Florida weather cycle. What was expected to be a “wet” wet season turned dry, and what looked to be a “dry” dry season turned wet. Shifts between flood and drought can occur quickly both within and during the transition between the approximate 6-month long wet and dry seasons.

### **Water Year 2020** (May 1, 2019 to April 30, 2020)

WY 2020 started with a normal onset of wet season rains only to be derailed into a drier than normal condition due to a record-low rainfall in September, largely as a result of several large tropical systems that disrupted the summer pattern. Similar to the previous water year, WY 2020 dry season started earlier than normal as a result (Figure 1). However, differing from WY 2019, a series of winter storms failed to materialize. Cold fronts proved too infrequent and lacked sufficient moisture to slow the steady decline of the water table. The virtual lack of any rainfall for the entirety of March sealed the region’s descent into a deep and prolonged drought. Wildfires erupted in the Big Cypress and Everglades in April and May and proved hard to contain due to the loss of surface and shallow ground water from the region’s normally wet soils. The wildfires threatened and, in some cases, significantly impacted, large areas of the ecosystem as well as threatened and endangered species found exclusively in both deep slough and upland habitats.

The Everglades and Big Cypress Swamp are flood- and fire-adapted ecosystems in which every square inch of flora and fauna depend on a regular return interval and dosage of both flood and fire. In WY 2020, a few months proved pivotal in tilting the region in favor of drought and the wildfires that ensued.

Of interest, both WYs 2019 and 2020, as judged by their annual rainfall of 52 and 48 inches, would appear at first glance to have fallen squarely within the normal 45 to 58 inches of rainfall window. Yet, a closer look reveals a two-year period that was plagued by a continual threat and eventual demise into an ecologically damaging and financially costly drought cycle.

## System-wide Ecological Indicators

### Helpful Hints for Reading the Indicators

Within the system-wide indicator tables, the “Current Reporting Year” column contains indicator information at the end of WY 2020 (May 1, 2019 to April 30, 2020) if available. The “Previous WY 2019” was added because some indicators could not be reported in WY 2020 because of COVID-19 restrictions that affected sampling, processing, or analysis. The ‘Previous Reporting Year’ column contains information for WY 2018 (May 1, 2017 to April 30, 2018). Status is shown using green, yellow, and red stoplight colors as explained below.

Ecological Indicator	Previous Reporting Year WY 2018	Previous Water Year WY 2019	Current Reporting Year WY 2020
Invasive Exotic Plants	Y	Y	C*
Lake Okeechobee Nearshore Zone Submerged Aquatic Vegetation	R	R	R
Eastern Oysters - <b>Modified (Northern Estuaries only)</b>	R	R	R
Crocodylians (American Alligators & Crocodiles) - <b>Modified (DOI Lands Only)</b>	R	R	C*
Fish & Macroinvertebrates (WCA-3 and ENP only)	R	R	R*
Periphyton - <b>Modified (no species composition)</b>	Y	Y	C*
Wading Birds (White Ibis & Wood Stork)	Y	R	R
Southern Coastal Systems Phytoplankton Blooms	R	Y	Y
Florida Bay Submersed Aquatic Vegetation	Y	Y	Y
Juvenile Pink Shrimp - <b>Modified (no system-wide sampling)</b>	B	B	B
Wading Birds (Roseate Spoonbill)	R	R	R

### Stoptlight Color Legend

- RED** (R) Substantial deviations from restoration targets creating severe negative condition that merits action. Well below restoration target.
- YELLOW** (Y) Current situation does not meet restoration targets and may require additional restoration action. Below restoration target.
- GREEN** (G) Situation is within the range expected for a healthy ecosystem within the natural variability of rainfall. Continuation of management and monitoring effort is essential to maintain and be able to assess “green” status. Meets restoration target.
- BLACK** (B) No data or inadequate amount of data were collected due to reductions in funding.
- CLEAR** (C) Sampling or analysis incomplete or delayed so stoplight not available.

\*Indicates lack of March/April 2020 data because of COVID-19.

Please see the 2020 System-wide Ecological Indicators for Everglades Restoration for more details including yearly values by area, improvements to calculations, and a list of publications and reports associated with all the indicators.

# Invasive Exotic Plant Indicator

STATUS	PREVIOUSLY REPORTED WATER YEAR 2018	WATER YEAR 2019	CURRENT WATER YEAR 2020
SYSTEM-WIDE	Y	Y	Sampling could not be completed because of COVID-19 restrictions

- The proliferation of invasive exotic plant species can lead to substantial negative impacts, both structurally and functionally, to native Everglades ecosystems. The presence of invasive exotic plants can directly impede restoration success. For this reason, the Invasive Exotic Plant Indicator is used to assess the status of invasive plant species and progress in their control.
- This indicator involves numerous invasive plant species across different jurisdictions and regions. Each species will respond to restoration uniquely. Two primary drivers affecting all invasive exotic plants is their population status (presence and abundance) and success of control efforts. Sustained and closely coordinated control efforts across jurisdictions is expected to result in reductions in invasive exotic plant populations and the impacts they exert on native ecosystems.
- All agencies currently operate invasive plant management programs, and regionwide monitoring programs exist for most priority species. However, landscape-level control is hampered by limited financial resources, remote infestations, and in some cases insufficient control methods. While large portions of the restoration footprint have reached “maintenance control” of priority invasive species, the overall geographic distribution of many species has increased. In some areas, populations previously under control have resurged.
- Management approaches that integrate numerous control techniques are proving useful. For example, integrating herbicide treatments, fire, and biological controls through Everglades restoration, specifically the Comprehensive Everglades Restoration Plan (CERP) Biological Control Implementation Project, is improving overall management outcomes for some invasive species. Continued improvements in invasive species management through coordinated planning, construction, and operational phases of restoration efforts (see CERP Guidance Memorandum 062.00, 2012) are needed to promote more cost-effective management.
- While large portions of the restoration footprint have been cleared and maintained at low infestation levels, the overall geographic distribution of many invasive plant species has increased and in some areas populations previously under control have resurged, largely due to inadequate resources for management. Key regions where invasive plant populations remain problematic include:
  - Kissimmee River floodplain (Old World climbing fern, Peruvian Primrose willow, numerous invasive grass species)
  - A.R.M. Loxahatchee National Wildlife Refuge (melaleuca, Old World climbing fern)
  - Picayune Strand (Brazilian pepper, melaleuca)
  - Everglades National Park—northeastern region (melaleuca, Brazilian pepper, Australian pine)
  - Big Cypress National Preserve—southern region (melaleuca, Brazilian pepper)
- Beyond direct control measures, restoration activities may affect invasive plant populations positively or negatively, depending on the unique characteristics of individual species and their responses to changing environmental conditions as restoration progresses. For example, longer durations of standing water may reduce the recolonization rates of Brazilian pepper in Everglades tree islands while increasing habitat suitability for Old World climbing fern.

On a system-wide scale the Invasive Exotic Plant indicator was below the restoration target (yellow stoplight) at the end of WY 2018 and remains below the restoration target at the end of WY 2019.

A stoplight color cannot be calculated for WY 2020 because spring sampling could not be completed due to COVID-19 restrictions.

# LAKE OKEECHOBEE NEARSHORE ZONE SUBMERGED AQUATIC VEGETATION (SAV) INDICATOR

STATUS	PREVIOUSLY REPORTED WATER YEAR 2018	WATER YEAR 2019	CURRENT WATER YEAR 2020
SYSTEM-WIDE	R	R	R

- Submerged aquatic vegetation (SAV) provides habitat for fish and wildlife, stability for sediments, and improves water quality. A healthy SAV community directly corresponds to healthy Lake Okeechobee conditions. The SAV community is directly influenced by hydroperiod, nutrients, and water quality.
- SAV coverage should expand with completion of Everglades Restoration projects that provide watershed storage and subsequently improve Lake Okeechobee stages (height of the water above mean sea level). Without these projects, unabated inflows from a channelized watershed will continue to drive high lake stages that drown SAV and emergent vegetation during wet conditions. Everglades Restoration will create storage capacity in the watershed, which will prevent dry conditions that drive lake stages down and expose SAV beds, converting open water areas to emergent marshes. It will also allow for favorable water levels that benefit lake ecology and reduced interannual variability should help SAV flourish beyond the 50,000-acre RECOVER restoration target.
- While several Everglades restoration projects, specifically CERP, will affect lake stages to some degree, only one upstream project, the Lake Okeechobee Watershed Restoration Project (LOWRP), would directly affect inflows to the lake and improve lake ecology. Through the construction of a reservoir, installation of aquifer storage and recovery wells, and wetland restoration in the watershed, lake stages are expected to remain within desired ranges more frequently, particularly under dry conditions. Over the long-term, such improvements to lake stages should increase coverage of SAV to established targets.
- To date, no projects have been completed that will impact lake stages. Therefore, watershed storage and downstream storage remain minimal to non-existent, and stages continue to deviate wildly from desired ranges, particularly during wet and dry events.
- SAV declined 81% from WY 2018 to WY 2019, primarily due to the damage incurred from Hurricane Irma in September 2017. WY 2020 saw a significant recovery, with a total coverage of 26,000 acres (74% of the interim RECOVER goal), aided by lake levels being within or below the ecological envelope for nearly a full year prior. This phenomenon also occurred when low water levels at the end of WY 2017 promoted SAV recovery in WY 2018, improving light penetration and encouraging reestablishment of SAV. While stages were below the ecological envelope for considerable periods of WY 2020, such low water levels are beneficial in recovering from high-water impacts like occurred from Hurricane Irma. While not recommended very often or for long durations, such low water levels are key to rebounds in SAV communities.

The SAV indicator was well below the restoration target (red stoplight) at the end of WY 2018 and remains well below the restoration target at the end of WY 2020.

# Eastern Oysters Indicator

STATUS	PREVIOUSLY REPORTED (WATER YEAR 2018)	(WATER YEAR 2019)	CURRENT (WATER YEAR 2020)
SYSTEM-WIDE	R	R	R

- Eastern oysters are a natural component of estuaries in south Florida that provide water quality benefits, habitat and food for many species, shoreline stabilization, and important commercial, recreational and economic resources for coastal communities.
- Eastern oysters are frequently used as indicators of water quality because they are a dominant species in the estuarine community and their sedentary nature allows for development of cause-and-effect relationships between environmental conditions and oyster population health and abundance.
- Restoration of more natural freshwater flows to the estuaries that protect against abrupt changes in estuarine salinity and temperature will stabilize oyster population health and abundance. Additionally, successfully restored freshwater flows will allow for reestablishment of oysters at estuarine locations that are currently uninhabitable.
- Eastern oysters would benefit most from the following Everglades restoration projects: the Indian River Lagoon-South project, and the Central Everglades Planning Project (CEPP) including the Lake Okeechobee System Operating Manual update. That is because these projects will improve conditions on both coasts of Florida by providing water storage, reducing detrimental freshwater flows, and maintaining the right amount of essential freshwater flow.
- Eastern oyster status was well below the restoration target for WY 2019 and WY 2020 in the Northern Estuaries (Caloosahatchee River Estuary, St. Lucie Estuary, Loxahatchee River Estuary, and Lake Worth Lagoon).
- In WY 2019, oyster populations in the St. Lucie and Caloosahatchee River estuaries began recovering following widespread mortalities that occurred as a result of poor water quality associated with Hurricane Irma in 2017.
- In WY 2020, oyster densities and juvenile recruitment rates continued to improve, but disease rates increased substantially in several estuaries.

On a system-wide scale the Eastern oyster indicator remains well below the restoration target because the majority of projects (see list of critical Everglades Restoration projects in the fourth bullet point above) that will benefit Eastern oysters have not yet been implemented.

# Crocodylians (American Alligators & Crocodiles) Indicator

STATUS	PREVIOUSLY REPORTED WATER YEAR 2018	WATER YEAR 2019	CURRENT WATER YEAR 2020
SYSTEM-WIDE (Modified USDOI lands only)	R	R	*Sampling could not be completed because of COVID-19 restrictions

- Crocodylians (alligators and crocodiles) are important ecosystem engineers in the Everglades and create both high ground (nests) and low area (alligator holes) habitats that promote species diversity in the ecosystem.
- Health and growth of both alligator populations and individuals are directly related to wetland hydrology and salinity.
- We expect positive responses in crocodylian growth, survival, body condition, and densities in marsh areas where Everglades Restoration projects (such as Modified Water Deliveries and the Tamiami Trail bridge projects) restore multi-year hydroperiods and more natural fluctuations in water depths.
- With the implementation of one group of Everglades restoration projects, the Central Everglades Planning Project (CEPP), we expect to see improvement in body condition and densities of alligators in areas where densities are currently low because of drier conditions, such as in northern Water Conservation Area (WCA) 3A and Northeastern Shark River Slough.
- We expect to see more crocodiles in better body condition with higher growth and survival rates in areas where projects that deliver more fresh water to coastal areas have been implemented.

On a system-wide scale the crocodylian indicator remains well below the restoration target because the majority of projects that will benefit crocodylians have not yet been implemented.

A full system-wide status assessment for crocodylians for WY 2018 - WY 2020 cannot be provided because some survey routes have not been sampled since funding was suspended in WY 2012. However, surveys have continued on some USDOI lands (LNWR, Crocodile Lake National Wildlife Refuge and ENP). Funding for surveys in WCA-3A and 3B was restored in WY 2016. Full spotlight assessment for WCA-3 can be included after completion of 5 years of data collection.

A spotlight color cannot be calculated for WY 2020 because spring sampling could not be completed due to COVID-19 restrictions.

# Fish & Macroinvertebrates Indicator

STATUS	PREVIOUSLY REPORTED WATER YEAR 2018	WATER YEAR 2019	CURRENT WATER YEAR 2020
SYSTEM-WIDE	R	R	R* *qualified by lack of April 2020 data because of COVID-19

- Fish and macroinvertebrates are important indicators in the Everglades because of their role as food for predators such as wading birds and alligators.
- Fish and macroinvertebrate density and community composition are correlated with hydrology and they integrate the effects of hydrology in all of their life stages.
- Positive or negative trends in fish and macroinvertebrate density relative to hydrological changes are correlated with trends in a restored Everglades ecosystem.
- With the implementation of one group of Everglades restoration projects, the CEPP, we expect to see increases in density of these animals in areas where hydrological conditions are currently drier than targeted because they will become wetter (e.g., ENP Shark River Slough and Taylor Slough, northern WCA-3A, WCA-3B), and no change or decline in areas where water is currently ponded and may become drier (e.g., southeastern WCA-3A).
- The time between drying events is a key driver of fish and macroinvertebrate density and species composition. We anticipate improvement in this indicator where projects that deliver more freshwater have been implemented.
- Water quality (total phosphorus concentration) also impacts the fish and macroinvertebrate indicator. Improved water quality by maintaining historical concentrates of total phosphorus in areas receiving enrichment will thus also improve this indicator.

On a system-wide scale, the fish and macroinvertebrate indicator remains well below the restoration target because the majority of Everglades restoration projects, specifically the CEPP, that will benefit these animals have not yet been implemented or are being implemented now.

The system-wide status assessment for fish and macroinvertebrates for WY 2020 must be viewed with caution because no data could be collected in April 2020 and processing of February 2020 data is delayed because of COVID-19 work restrictions. February and April are critical dry-season months and these data are influential in determining stoplight assessments in past years. Field sampling has been restarted and we hope to use hydrological analyses and modeling to correct for uncertainty in the WY 2020 stoplight in future work.

# Periphyton Indicator

STATUS	PREVIOUS REPORTING WATER YEAR 2018	PREVIOUS WATER YEAR 2019	CURRENT WATER YEAR 2020
SYSTEM-WIDE	Y	Y	Processing could not be completed in time for this report because of COVID-19 restrictions*

- Periphyton abundance, nutrient content, and diatom algae species composition provide an important indication of the oligotrophic, or low nutrient, status of the Everglades. These three metrics are combined into a multi-metric index to provide an indication of how hydrologic management influences the inflow and downstream transport of novel and legacy phosphorus (phosphorus already accumulated in the soil).
- The multi-metric index is a combination of periphyton biomass, phosphorus concentration, and the proportion of calcareous diatom species comprising the periphyton community.
- We expect a reduction in biomass, an increase in phosphorus concentration, and a reduction in calcareous diatoms at locations experiencing above-ambient phosphorus loads. A modified index is used for the Arthur R. Marshall Loxahatchee National Wildlife Refuge, where an increase in biomass and calcareous diatoms indicates a departure from ambient conditions.
- If total phosphorus concentrations of inflowing water are lower than ambient marsh concentrations, we expect that one group of Everglades Restoration projects, the CEPP, will improve the quantity, quality, and calcareous composition of periphyton communities.

On a system-wide scale the periphyton indicator remains below the restoration target in central and northern WCA-3A and WCA-2A because these areas have not recovered from a history of higher than ambient phosphorus loading and have not received the benefits of restoration projects that have not yet been implemented. Downstream/coastal regions of Everglades National Park are below the restoration target because they are receiving increasing amounts of marine-sourced phosphorus in the absence of full-scale Everglades Restoration implementation.

\*A full system-wide status assessment for periphyton and the stoplight color for WY 2020 cannot be provided yet because of delays in the microscopic identification of diatoms due to a slow-down of activities related to COVID-19 restrictions but should be available by early Fall 2020.

# Wading Birds (Wood Stork & White Ibis) Indicator

STATUS	PREVIOUSLY REPORTED WATER YEAR 2018	WATER YEAR 2019	CURRENT WATER YEAR 2020
SYSTEM-WIDE	Y	R	R

- We have pre-drainage information that shows us that large numbers of wading birds were a defining characteristic of the pre-drainage Everglades. Wading bird nesting is strongly driven by hydrology, through both production of and access to aquatic prey animals.
- With Everglades restoration, we expect to see earlier nesting by Wood Storks, a shorter interval between White Ibis “supercolony” nesting events, a higher ratio of tactile to visual foragers, and a higher proportion of nesting concentrated in coastal areas of Everglades National Park.
- Wading bird nesting responds to system-wide, large-scale changes in water depth, hydroperiod, and seasonal patterns; therefore, the benefits of individual projects that contribute piecemeal to hydrological restoration are unlikely to be reflected in this indicator.
- Following exceptional rainfall and ideal water levels, the spring 2018 nesting event strongly suggests that restored flows and hydroperiods will result in larger nesting numbers and increased nesting success.
- In WY 2019 and WY 2020, the less than optimal hydrological conditions both for production and access to prey, resulted in low nesting numbers and late nesting. The contrast of these three years (2018, 2019, and 2020) signaled that large responses in wading bird nesting may not be consistently observed until hydrological thresholds have been reached.
- Everglades Restoration projects that restore freshwater flows to the productive southwest estuarine region are seen as key to restoring wading bird nesting.
- It is difficult to associate wading bird nesting responses on a system-wide basis with any particular project, though those that contribute the most to restoration of hydrological flows typical of the pre-drainage period are those that would be highest priority.

The wading bird indicator remains well below the restoration target because the majority of Everglades Restoration projects that will affect the overall landscape have not yet been implemented.

# Southern Coastal Systems Phytoplankton Blooms Indicator

STATUS	PREVIOUSLY REPORTED WATER YEAR 2018	WATER YEAR 2019	CURRENT WATER YEAR 2020
SYSTEM-WIDE	R	Y	Y

- Phytoplankton blooms, commonly called algal blooms, are an indicator of water quality. In the context of Everglades Restoration, the bloom indicator is cautionary, helping to ensure that restoration actions cause no indirect harm to coastal ecosystems via water quality degradation.
- We expect that implementation of Everglades restoration projects will not degrade and may indeed improve water quality conditions because restored plant communities and soils are expected to increase nutrient uptake and retention in Everglades wetlands and estuarine seagrass beds.
- However, unlike other indicators where we expect to see continual improvement, our expectation with the algal bloom indicator is that the frequency of red status will not increase once Everglades Restoration projects that affect coastal ecosystems are implemented. We expect to “do no harm”.
- There was improvement in algal bloom indicator scores in the entire Southern Coastal System (SCS) region (Ten Thousand Islands to Biscayne Bay) since the 2018 reporting when the indicator was well below the restoration target (red), reflecting impacts of seagrass die-offs and Hurricane Irma.
- Improvements were most dramatic in Florida Bay, in which all four subregions had good (green, above target) bloom indicator scores in WY 2020, a result not seen since WY 2009. However, Biscayne Bay conditions remain a concern, with the central bay having persistent poor indicator scores.
- Improved SCS conditions reflect a recovery from the seagrass die-offs and hurricane impacts described in the 2018 report.
- This ecological recovery in the SCS coincided with implementation of the Modified Water Deliveries Project Incremental Tests and several Everglades restoration projects, including the C-111 Spreader Canal Western Project and Biscayne Bay Coastal Wetland Project Phase 1. This suggests that the projects’ operations are not causing harm via coastal water quality degradation and algal blooms.

The SCS Phytoplankton Blooms Indicator is below restoration targets; however, it showed improvement since the 2018 reporting.

# Florida Bay Submersed Aquatic Vegetation Indicator

STATUS	PREVIOUSLY REPORTED WATER YEAR 2018	WATER YEAR 2019	CURRENT WATER YEAR 2020
SYSTEM-WIDE	Y	Y	Y

- Submersed aquatic vegetation (SAV) is a critical component of the Florida Bay ecosystem providing habitat, nursery, nutrient removal, sediment stabilization, and aesthetic functions. *Thalassia testudinum* (Turtlegrass), *Halodule wrightii* (Shoalgrass), and *Syringodium filiforme* (Manatee grass) form the basis for Florida Bay’s biodiversity, recreational fishery, and tourism.
- The SAV community has been threatened in recent decades by a confluence of factors, most prominently high salinity, that kill *Thalassia*, leading to large denuded areas of bay bottom in what is known as “die-off.” Major die-offs occurred in 1987 and another in 2015 when lack of Everglades freshwater discharge led to bay salinities twice that of natural seawater.
- A goal of Everglades restoration projects, particularly the C-111 Spreader Canal Project and the Florida Bay Plan, is to divert more freshwater into Florida Bay from the Everglades in a way that is consistent with historical, pre-drainage hydrology. The primary objective is to improve the health and vigor of the SAV community by reducing high salinities.
- Since 2015, SAV in Florida Bay has been impacted by a series of successive events: severe drought leading to prolonged hypersalinity that then caused a die-off event, direct hits from Hurricane Irma and other destructive tropical storms, and prolonged algal blooms. The 2018 System-wide Indicators Report for Florida Bay reflected this with a yellow caution score for SAV, including yellow status in three of five bay regions and green in two.
- In 2019, conditions for SAV improved to green in the central region, though the bay-wide status indicator remained yellow.
- The current status for SAV in 2020 again reflects a yellow score overall, though conditions slowly continue to improve as algae declined, bay waters cleared, and salinity remains in a normal range.

The Florida Bay SAV indicator remains below the restoration target at the end of WY 2020; however, conditions continue to slowly improve.

# Juvenile Pink Shrimp Indicator

STATUS	PREVIOUSLY REPORTED WATER YEAR 2018	WATER YEAR 2019	CURRENT WATER YEAR 2020
SYSTEM-WIDE	B	B	B

Funding for system-wide sampling was suspended in WY 2012; therefore, no data were available for the system-wide assessment of the juvenile pink shrimp indicator condition at the end of WY 2020.

See the 2020 System-wide Ecological Indicators for Everglades Restoration for results on areas where sampling did occur.

# Wading Birds (Roseate Spoonbill) Indicator

STATUS	PREVIOUSLY REPORTED WATER YEAR 2018	WATER YEAR 2019	CURRENT WATER YEAR 2020
SYSTEM-WIDE	R	R	R

- Roseate Spoonbill foraging and nesting are directly correlated to hydrology and prey availability. Several water management practices, including those that altered hydroperiods, reduced freshwater flow, and made the coastal mangrove zone north of Florida Bay much more saline, resulted in reduced productivity of spoonbill prey that ultimately led to major declines in nesting activity.
- Restoration activities designed to restore the proper quantity, timing, and distribution throughout the Everglades should stabilize hydroperiods, reduce salinity, increase prey productivity, and result in greater nesting success and increased nesting activity of Roseate Spoonbills.
- Everglades restoration projects that will result in these desired affects are C-111 Spreader Canal Phase 2 (Biscayne Bay and Southeastern Everglades Ecosystem Restoration), Combined Operations Plan (COP), implementation of the Modified Water Deliveries Project to ENP (Mod Waters), and CEPP.
- Phase 1 of the C-111 Spreader Canal was completed in 2012 and has shown some evidence of achieving restoration goals by increasing flows to Florida Bay through Taylor Slough and marginally lowering salinity. The C-111 project built and operated by the SFWMD does not, however, seem to be operated in such a way as to improve conditions in either very low or very high rainfall periods and may actually exacerbate these extreme conditions.
- Spoonbills appear to be responding positively, albeit incrementally, to Everglades Restoration efforts designed to improve conditions in Florida Bay. Prey appear to have slightly increased productivity and several spoonbill nesting success submetrics responded well enough to be scored as green; however, the number of spoonbill nests have remained very far below targets, indicating that spoonbill chicks hatched in Florida Bay are not finding foraging conditions suitable for them to return as adults to establish nesting.

The Roseate Spoonbill indicator is well below restoration targets; however, it is showing improvement.

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# **Appendix B**

## **Invasive Exotic Species Strategic Action Framework: Case Studies**

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# Invasive Exotic Species Strategic Action Framework: Case Studies

The South Florida Ecosystem Restoration Task Force (Task Force), recognizing the serious threats to the Everglades posed by invasive exotic plants and animals, has established an Invasive Exotic Species Strategic Action Framework (Framework). The Framework was developed by an extensive and diverse set of partners including members of the Task Force, Working Group, Science Coordination Group, and the Everglades Cooperative Invasive Species Management Area (ECISMA). The Department of the Interior’s Office of Everglades Restoration Initiatives (OERI) coordinated the development of the original 2015 Framework as well as the 2020 update.

The Framework seeks to help decision-makers understand the connections between goals, strategies, and tactics; maximize the extent to which the current capacity for partnership is leveraged to meet common goals; and help decision-makers make wise and timely investment decisions in the battle against invasive exotics.

The key to tackling a problem as complex as invasive exotic species is to prioritize both threats and solutions, and to identify the relative cost of our prioritization choices. The Invasion Curve (see next page), first developed by experts in Australia and broadly accepted and applied, organizes the battle against exotics into four phases: 1) Prevention, 2) Eradication through Early Detection and Rapid Response (EDRR), 3) Containment, and 4) Long-Term Management/Resource Protection. The curve also shows the relationship of each of these phases to the duration and extent of the invasion, and the costs of addressing it. The Invasion Curve tells us that the longer we wait to address a particular invasion and the more widespread that invasion becomes, the more expensive it is to address. In general, the most cost-effective approach to controlling invasive exotic species is to prevent the introduction of the species in the first place. If prevention is not possible, EDRR is the next most cost-effective strategy to employ. If opportunities to prevent or swiftly eradicate the species are missed, costs of addressing the invasion begin to rise very quickly. Once a species has crossed into the yellow and red zones of the Invasion Curve, the costs of management are high and perpetual.

A series of Case Studies was developed for the 2020 Framework to highlight species of concern, current activities, successes, and continued challenges within each of the four goal areas:

- |                       |  |
|-----------------------|--|
| Prevention:           | Exotic Pet Amnesty Program<br>Risk Screenings and Assessments          |
| Eradication/EDRR:     | Exotic Species Hotline<br>New World Screwworm Fly<br>Lumnitzera        |
| Containment:          | Argentine Black and White Tegu   |
| Long-term Management: | Burmese Pythons<br>Lionfish<br>Invasive Plant Coordination and Funding |

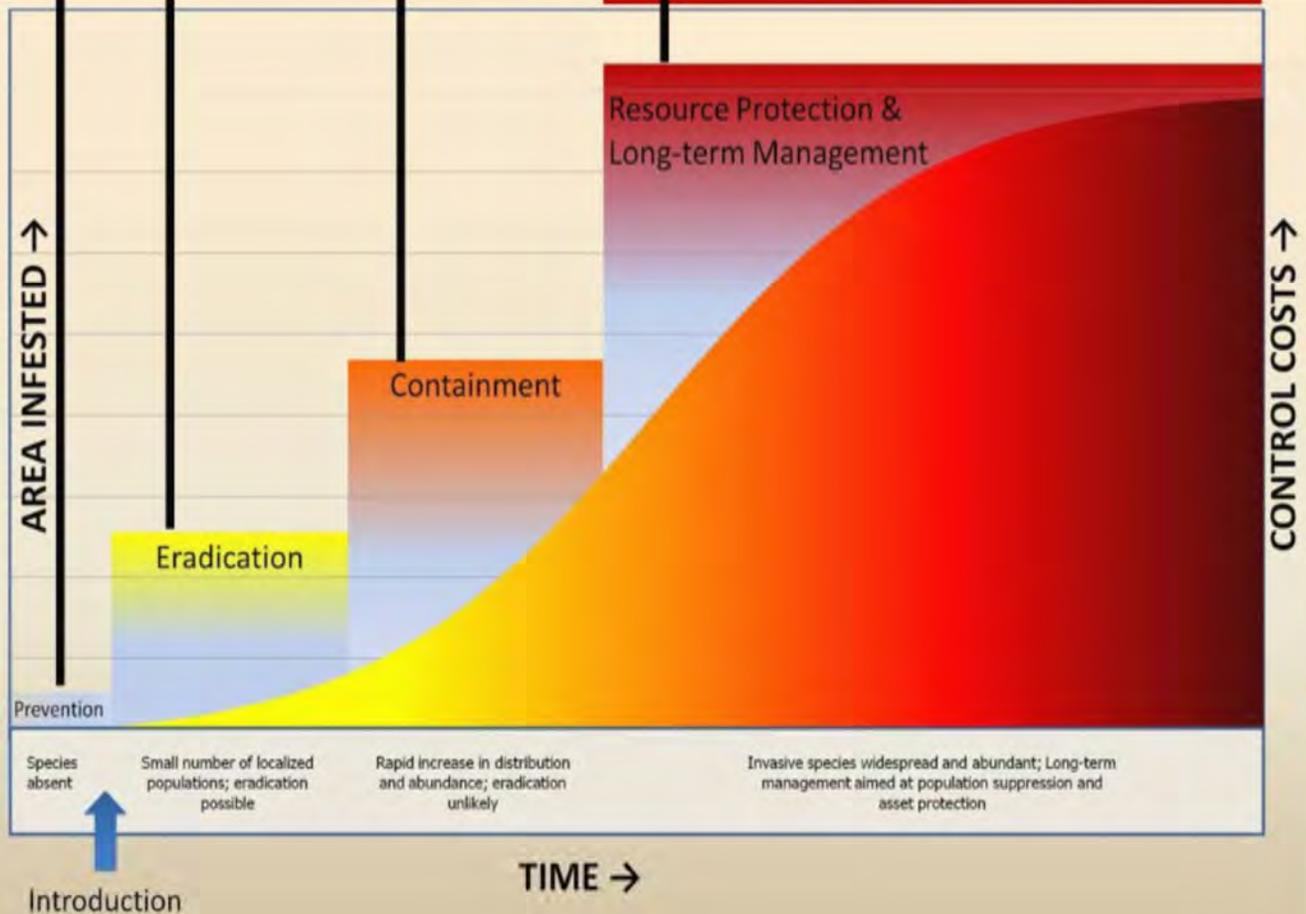
# THE INVASION CURVE AND STRATEGIC GOALS

**Goal 1:** Prevent the introduction of invasive exotic species.

**Goal 2:** Eradicate invasive exotic species by implementing Early Detection and Rapid Response (EDRR).

**Goal 3:** Contain the spread of invasive exotic species.

**Goal 4:** Reduce the populations of widely established invasive exotic species and maintain at lowest feasible levels.



# South Florida Ecosystem Restoration Task Force

## Invasive Exotic Species Strategic Action Framework

### *Prevention Case Study: Exotic Pet Amnesty Program*

#### Exotic Pets: Pathway for Invasive Species

The Florida Fish and Wildlife Conservation Commission's (FWC) **Exotic Pet Amnesty Program (EPAP)** is an innovative effort that provides exotic pet owners with an opportunity to surrender or re-home their exotic pet. Exotic pets are not native to Florida and are a primary introduction pathway for invasive wildlife in the state. It is illegal to release nonnative wildlife in Florida. Released or escaped exotic pets can present a threat to Florida's native wildlife. The goal of the amnesty program is to reduce the number of nonnative species released into the wild by pet owners by providing a convenient, legal alternative. The program also provides education and outreach regarding responsible pet ownership and exotic species in Florida.

#### Preventing the Release of Exotic Pets

The EPAP was created in 2006 and codified into law in 2008 (Chapter 68-5, F.A.C.). Through EPAP, pet owners can surrender their unwanted exotic pets, whether kept legally or illegally, without penalty or cost. The FWC also facilitates rehoming these pets with prequalified adopters. To date, over 6,100 exotic pets have been surrendered to the state through this innovative program.

People who can no longer care for their exotic pets are able to surrender these animals, including Conditional species that can no longer be acquired for personal possession in Florida, to the FWC at **Exotic Pet Amnesty Days** held throughout the state. Typically, 3-5 events are held each year. Surrendered pets are given an exam by a veterinarian and healthy animals are made available for adoption to FWC's pre-approved adopters on the same day. Conditional species can be adopted by permitted recipients only. EPAP currently has over 700 active adopters.

Exotic pet owners who cannot attend an Exotic Pet Amnesty Day can contact the FWC's **Exotic Species Hotline** at **888-Ive-Got1** (888-483-4681) for year-round assistance in finding their animal a new home.

Another goal of EPAP is to encourage responsible pet ownership through outreach and education at Exotic Pet Amnesty Day events. The FWC and partners strive to spread the **"Don't Let It Loose"** message to prevent release of nonnative wildlife into Florida.

#### Innovation Yields Success

Florida is the first state to have an established amnesty program to provide options for owners of exotic species. The framework of this program has served as a resource for other states and nations, such as Georgia, Ohio, Arizona, and Australia, working to build similar programs.

There has been continued success with FWC's EPAP. From 2006-2014, FWC held 30 events with over 2,300 exotic pets surrendered. As efforts ramped up since 2015, FWC hosted an additional 19 events with over 3,700 additional exotic pets surrendered. This total since 2015 includes over 430 Conditional animals (species that may only be imported and possessed for research purposes, commercial use, or public exhibition, not as personal pets) that were not released into the wild.



**Exotic Pet**  
**Amnesty Program**  
**Great pets. Great homes.**

For more information:  
[MyFWC.com/nonnatives](http://MyFWC.com/nonnatives)  
888-Ive-Got1 (888-483-4681)

## Interested in Adopting an Animal?

The FWC is always looking for experienced exotic pet owners to be adopters in the Exotic Pet Amnesty Program. It's free - there are no fees to apply or adopt an animal through the program. However, the cost of supporting a pet for the remainder of its life should be taken into account before applying.

In order to adopt an animal through EPAP you must apply and be approved as an adopter. The FWC requires adopters to understand how to properly care for the animals they want to adopt. Approved adopters will receive a letter of acceptance; adopters must bring their letter of acceptance to each Exotic Pet Amnesty Day event that they wish to attend.

### Steps:

- Fill out and submit an application at [MyFWC.com/Nonnatives](https://myfwc.com/Nonnatives).
- Complete an Applicant Information Form and at least one Animal Information Form. The Animal Information Form has a drop-down list of animal categories; choose one category per animal form.
- Applicants who are approved as adopters will receive a letter of acceptance from the FWC and will be informed of upcoming Exotic Pet Amnesty Days in their area.
- All adopters must apply and be approved before adopting an animal at an Exotic Pet Amnesty Day event.



Veiled chameleon at an EPAP event.

Photo courtesy of Rebekah Nelson, FWC, [Bugwood.org](https://bugwood.org)

# South Florida Ecosystem Restoration Task Force

## Invasive Exotic Species Strategic Action Framework

### *Prevention Case Study: Risk Screenings and Assessments*

#### Calculating Risk

The State of Florida is at risk of invasive exotic species particularly through live animal trade. Nonnative invasive wildlife issues in Florida have increased in frequency and severity over the last decade. Although invasive exotic species are not a problem unique to Florida, Florida's subtropical climate has been conducive to the establishment and expansion of many exotic species including large constrictor snakes like the Burmese python; large lizards, such as monitors, tegus, and iguanas; freshwater fish species like bullseye snakehead; and marine species, such as lionfish. To address these challenges, the Florida Fish and Wildlife Conservation Commission (FWC) has increased management efforts focused on prevention and early detection and rapid response (EDRR) of priority nonindigenous invasive animal species.

#### Tools for Prevention and Rapid Response

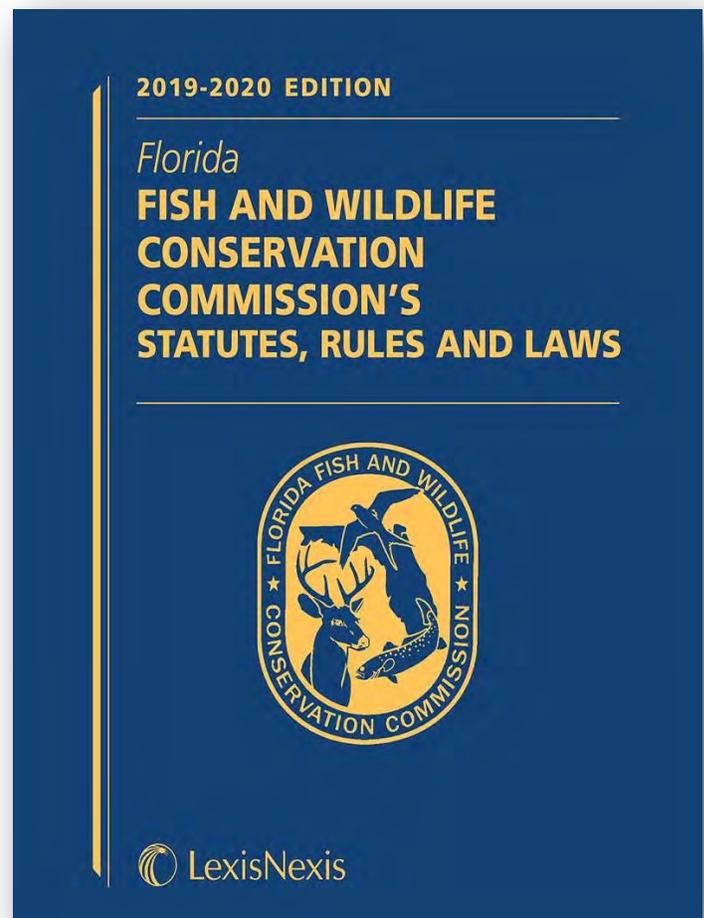
Risk screenings and assessments are key components of the FWC's invasive species prevention efforts. **Risk screenings** are quick evaluations that help gauge a species' potential invasion capabilities in a matter of hours. **Risk assessments** are more comprehensive investigations into a species that can take months to complete. Both screenings and assessments take into account a species' biology including natural history traits such as reproductive rate, history of invasion, ability to spread beyond initial introduction points, and climate suitability. Risk screening and risk assessment results help inform management decisions, including whether to conduct EDRR efforts or develop new regulations.

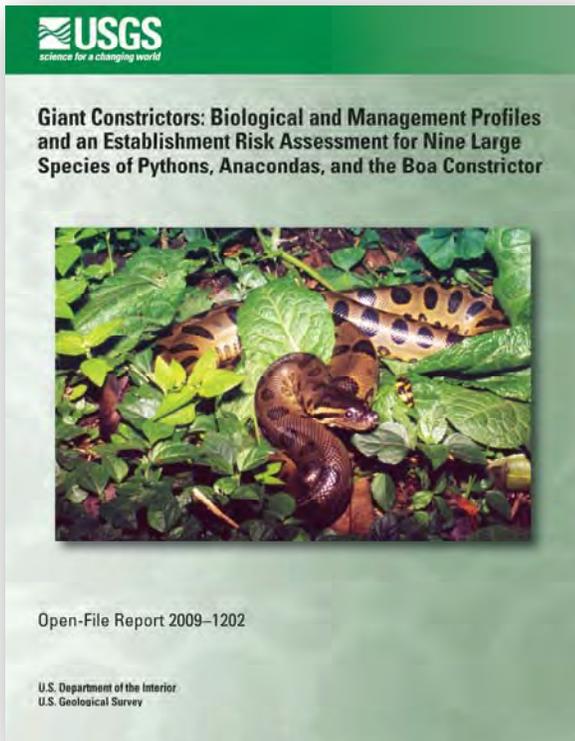
Multiple tools are available to conduct risk screenings. The FWC primarily uses a go/no-go EDRR tool developed by the University of Florida (UF) to conduct terrestrial species risk screens. For aquatic species, the FWC typically contracts researchers at UF to use the Fish Invasiveness Screening Kit (FISK) and Aquatic Species Invasiveness Screening Kit (AS-ISK). For full risk assessments, the FWC has contracted UF researchers to assess species

using the federal Nuisance Aquatic Species Task Force's Generic Nonindigenous Aquatic Organisms Risk Analysis Review Process. This framework has been accepted and used broadly, including use in the US Geographic Survey's (USGS) 2009 giant constrictor establishment risk assessment conducted to evaluate nine large constrictor snakes as injurious reptiles under provisions of the federal Lacey Act.

#### Prevention through Regulation

The FWC has used both screenings and assessments in recent years. Most recently, the FWC added a new suite of species to the state's Prohibited list. The species included birds, mammals, and reptiles that were already listed as injurious wildlife under title 18 of the federal Lacey Act. Following a federal court ruling in 2017, injurious wildlife may now be transported between the 49 States within the continental U.S. (the contiguous 48





## Conclusion

Moving forward, the FWC will continue to use risk screenings and assessments to make science-based, informed decisions when deciding whether to regulate a species. The go/no-go tool will also continue to be used in informing EDRR decision making. These tools are vital to the state's continued efforts in preventing the introduction, establishment, and spread of nonnative invasive fish and wildlife.

## Additional Resources

Aquatic Nuisance Species Task Force (ANSTF), Generic Nonindigenous Aquatic Organisms Risk Analysis Review Process: [https://www.anstaskforce.gov/Documents/ANSTF\\_Risk\\_Analysis.pdf](https://www.anstaskforce.gov/Documents/ANSTF_Risk_Analysis.pdf)

FISK and AS-ISK: <https://www.cefas.co.uk/services/research-advice-and-consultancy/non-native-species/decision-support-tools-for-the-identification-and-management-of-invasive-non-native-aquatic-species/>

Species Currently Listed as Injurious Wildlife under the Federal Lacey Act (18 U.S.C. 42): [https://www.fws.gov/injuriouswildlife/pdf\\_files/Current\\_Listed\\_IW.pdf](https://www.fws.gov/injuriouswildlife/pdf_files/Current_Listed_IW.pdf)

State of Florida Prohibited Species and Rule Development: <https://myfwc.com/wildlifehabitats/nonnatives/rule-development/>

USGS Giant Constrictor Establishment Risk Assessment: <https://pubs.er.usgs.gov/publication/ofr20091202>

States and Alaska) without the previously required federal permit. Florida relied on the protections that had been in place prior to the ruling to keep these potentially harmful species from entering the state. The FWC used risk screenings and the USGS's 2009 giant constrictor establishment risk assessment to support listing the brown tree snake, yellow anaconda, Beni anaconda, DeS-chauensee's anaconda, Java sparrow, red-whiskered bulbul, dioch, pink starling, brushtail possum, dhole, flying foxes, mongoose, meerkats, and raccoon dog as prohibited state species.

These birds, mammals, and reptiles are all listed as injurious wildlife under the Lacey Act, but previously had no other restrictions in Florida. The FWC Prohibited listing limits their possession to qualifying, licensed facilities for educational exhibition and research use. These species may no longer be possessed as personal pets or for commercial sales in the state. The FWC did allow people who had any of these animals as pets to obtain a grandfathered pet permit to keep those pets for the life of the individual animals. Grandfathered pet permits are offered at no-cost.



Mongoose removed from Port Everglades.  
Photo courtesy of FWC.

# South Florida Ecosystem Restoration Task Force Invasive Exotic Species Strategic Action Framework

## *EDRR Case Study: Exotic Species Hotline*

It is imperative to respond quickly and deal with emerging invasive exotic species (IES) while they remain localized. This process is called Early Detection and Rapid Response (EDRR). Eradication through EDRR is the second most cost-effective method to deal with invasive exotic species, after prevention. Early detection requires effective communication between experts, responders, and the public and should seamlessly connect to the assessment and rapid response phases of EDRR.

### **IES Reporting Tools**

In addition to agency monitoring programs and formal detection efforts, easily understood and accessible IES reporting mechanisms for use by the public are vital to EDRR success. Florida's **Exotic Species Hotline** was developed in cooperation with the Nature Conservancy, Everglades National Park, and the Florida Fish and Wildlife Conservation Commission (FWC). The hotline was initially established for Burmese python reporting in the Florida Keys. The success of this hotline was then extended to the mainland in 2009 and transferred to the FWC in 2011 to obtain reports of any nonnative wildlife statewide. Also that year, the hotline merged with the FWC's Exotic Pet Amnesty Program hotline.

To supplement the Exotic Species Hotline, a free smart phone app, **IveGotOne**, was developed so people can report observations and upload photos of the sighted animals online. The "IveGot1" app was developed by the University of Georgia's Center for Invasive Species and Ecosystem Health through a cooperative agreement with the National Park Service. The FWC and the University of Florida Center for Aquatic and Invasive Plants were also part of the app development. Data from all sources are shared across FWC and EddMaps, the web-based Early Detection and Distribution Mapping System for invasive exotic species.

### **Impact of Public Reporting**

The Exotic Species Hotline, IveGot1.org, and the IveGot1 smartphone app reporting tools are instrumental in EDRR and have helped determine new areas where pop-

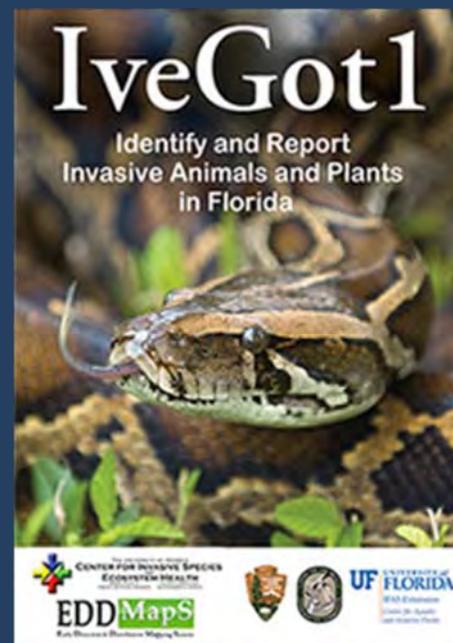
ulations may be establishing. For example, reports from these sources led to the discovery of an emergent Argentine black and white tegu population in Charlotte County in 2018 where over 100 tegus have now been removed to date.

### **Conclusion**

The exotic species hotline, currently managed by the FWC, has received 12,153 reports since its statewide inception in 2011. An additional 5,611 reports have been received via Ivegot1.org and the smart phone application. This equates to a combined total of 17,764 reports in Florida, building an extensive geospatial database where snakes are located and have been introduced on the landscape, increasing knowledge of the spread of invasive exotic species in Florida, and enabling rapid response to eradicate emerging invaders.

### TO REPORT INVASIVE EXOTIC SPECIES

Call 888-IveGotOne, (888) 483-4681,  
Visit IveGotOne.org, or  
Download the app:



Details on next page.

## Report Sightings of Invasive Exotic Species to the FWC

[From MyFWC.com/wildlifehabitats/nonnatives/report/](http://MyFWC.com/wildlifehabitats/nonnatives/report/)

Reporting observations helps us manage nonnative species. The best reports of nonnative species are credible reports. These are reports that the species in question can be verified and all necessary data has been included.

Credible reports contain 3 elements:

- 1) A photograph showing the animal in question that is not blurry and has a high enough resolution so that it can be enlarged to ensure species identification
- 2) The location where the animal was seen. GPS coordinates are best, but the location can also be a street address or detailed description of the area.
- 3) The date when the animal was seen.

You can report any other information that you think is valuable.

### Smartphone App

You can quickly and easily report sightings of nonnative species by using the free IveGot1 app, which was developed by The University of Georgia's Center for Invasive Species and Ecosystem Health. The app is available for iPhone and Android phones by searching for "IveGot1" at the appropriate app store. Reporting nonnatives using the IveGot1 app or the IveGot1 website is preferred for **lower priority species**, such as small nonnative lizards and iguanas.

### Online

You can use the web form at [IveGot1.org](http://IveGot1.org) to report nonnatives. The form will prompt you for the information and has a map where you can select the location if you do not have the GPS coordinates. You will need to create a free account the first time you report a sighting online. Reporting nonnatives using the IveGot1 app or the IveGot1 website is preferred for **lower priority species**, such as small nonnative lizards and iguanas.

### Exotic Species Hotline

You can call the FWC's Exotic Species Hotline at 888-Ive-Got1 (483-4681) to report nonnative species. The FWC asks the public to call the Hotline to report **high priority species**, which include all nonnative snakes, monitor lizards, tegus, and chameleons. The Hotline is answered part-time 7 days per week by a live operator and has a voicemail system that will prompt you for information about your sighting and your contact information if the operator is unable to answer the call.

# South Florida Ecosystem Restoration Task Force

## Invasive Exotic Species Strategic Action Framework

### *EDRR Case Study: New World Screwworm Fly*

The **New World screwworm fly** (NWSF), endemic to South America, poses a significant threat to livestock and other mammals. These invasive exotic flies lay larvae in open wounds; the resulting screwworms then feed on the animal's flesh, causing serious discomfort and itching. If left untreated, screwworm infestations can be fatal. A known parasitic pest, a recent occurrence of the NWSF in the Florida Keys spurred a successful Early Detection and Rapid Response (EDRR) interagency effort.

#### **A Coordinated EDRR Effort**

In September 2016, a multi-agency rapid response was initiated due to a positive detection of NWSF in an endangered key deer on the National Key Deer Refuge. NWSF had previously been eradicated in the southeast United States, including Florida, by 1960 (Novy 1991). Following its detection in the Lower Keys, a unified Incident Command System (ICS) structure was established between four primary agencies that included the Florida Department of Agriculture and Consumer Services (FDACS), the US Department of Agriculture's Animal and Plant Health Inspection Service (USDA-APHIS), Monroe County, and the US Fish and Wildlife Service (USFWS). It was later determined that the ICS strategy was essential to effectively managing the outbreak (Hennessey et. al. 2019).

#### **Successful Eradication**

Eradication was ultimately achieved using a multi-faceted approach that included mass sterile male fly releases (to reduce the likelihood that a fertile male fly will mate with a fertile female fly thus reducing the population); monitoring for disease spread; quarantine check points that included health inspections for domestic animals; containment and treatment of infected Key deer; euthanizing afflicted deer; proper disposal of deer carcasses; and community education and engagement (Hennessey et. al. 2019). Local volunteers provided invaluable assistance during the response.

The NWSF was declared eradicated on March 31, 2017, a mere seven months after its initial detection. Over 200

million sterile male flies were released on remote islands and in strategic locations on the mainland and over 17,000 animals received health checks (FDACS 2017). Roughly 15% of the endangered key deer population was lost (Hennessey et. al. 2019). Response costs likely exceeded \$5 million (Skoda et. al. 2018).

#### **Conclusion**

The coordinated effort was an excellent example of EDRR to a newly detected, highly invasive species, and the response met all criteria in the federal definition for an invasive species: 'an introduced species that is likely to cause economic or ecological harm, or is a threat to public safety'. There were direct risks to the Florida livestock industry, threatened and endangered species, and, although rare, cases of NWSF have been documented in humans. The source of the infestation remains unclear.



**New World Screwworm Fly (top) and mature larvae (bottom).**

Photos courtesy of USDA-APHIS.

## New World Screwworm Infestation: Before and After Treatment



Above, an active open wound infestation in an endangered Key deer.

Right, post-treatment with topical antibiotics.

Photos courtesy of USFWS.



### Sources:

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Novy, J.E. 1991. Screwworm control and eradication in the southern United States of America. [Internet: Accessed 2016 Oct 20]. <http://www.fao.org/docrep/U4220T/U4220T0A.HTM>.

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# South Florida Ecosystem Restoration Task Force

## Invasive Exotic Species Strategic Action Framework

### *EDRR Case Study: Lumnitzera*

The mangrove tree lumnitzera (*Lumnitzera racemosa*) was introduced to the United States in 1964 when two specimens obtained from Taiwan were planted in Fairchild Tropical Botanic Garden in Coral Gables, Florida. From these plants, Fairchild staff propagated more. Eventually 14 individuals were planted at Fairchild and six additional plants were sold to garden members in the 1970s. The fate of the sold plants is unknown. Lumnitzera was discovered to have escaped from cultivation at Fairchild in late 2008. Surveys conducted in 2009 found that the species had spread to approximately 19 acres of mangrove habitat in Fairchild and neighboring Matheson Hammock Park, a Miami-Dade County Park with natural areas managed by the County's Environmentally Endangered Lands (EEL) Program. The aggressive growth of the plant in native mangrove habitat raised concern among regional invasive species specialists who initiated a concerted effort to respond rapidly with monitoring and removal efforts. Field observations and scientific literature were provided to the University of Florida Institute of Food and Agricultural Sciences for a risk assessment using the Assessment of Non-native Plants in Florida's Natural Areas Predictive Tool. Lumnitzera was determined to have a high invasion risk. The US Department of Agriculture's Animal and Plant Health Inspection Service (USDA-APHIS) lists lumnitzera as "Not Authorized Pending Risk Analysis." Ongoing management efforts are aimed at eradication due to the localized distribution of the plant in Florida.

#### Case Presentation

The discovery of the lumnitzera invasion happened to co-occur with formation of the Everglades Cooperative Invasive Species Management Area (ECISMA). Through ECISMA, biologists from multiple agencies across South Florida participated in monitoring and removal workdays. These efforts not only resulted in the removal of an estimated 4,500 plants, but also served to train biologists throughout the region to identify this species, which can be very difficult to tell apart from co-occurring native mangroves. Some of the agencies participating in the

efforts included Miami-Dade County Natural Areas Management, Miami-Dade County EEL, Miami-Dade County Department of Environmental Resources Management, US Fish and Wildlife Service, Florida Fish and Wildlife Conservation Commission (FWC), the National Park Service, The Nature Conservancy, Broward County Parks, the Miccosukee Tribe of Indians of Florida, the National Oceanic and Atmospheric Administration, the US Army Corps of Engineers, USDA, South Florida Water Management District, private vegetation management companies, and Fairchild Tropical Botanic Garden.



Finding lumnitzera amongst native mangroves can be like looking for a needle in a haystack. Photo: Brian Harding, Fairchild Tropical Botanic Garden.

#### Management Actions and Outcome

Though no formal rapid response program was in place at the time, collaborative efforts between Fairchild Garden, Miami-Dade County EEL, and other members of ECISMA resulted in significant progress toward eradication. However, the plant has proven to be challenging to eradicate from its very localized distribution. The greatest strides toward eradication were achieved when funding was obtained through FWC's Invasive Plant Management Uplands Program and contractors were hired to remove lumnitzera from the infested areas. To date, it is estimated that more than 50,000 stems have been removed by contractors and volunteers.

More than a decade after its spread was discovered, the complete eradication of lumnitzera continues to pose challenges. Academic research has shed some light on



More than 50,000 lumnitzera stems have been removed by volunteers and contractors since eradication began. Contracted work ceased in 2016 but annual volunteer workdays continue. Source: Fairchild Tropical Botanic Garden.

the species' ecology and biology. Its ability to colonize established, undisturbed mangrove communities was unsettling in part because these communities were previously thought to be somewhat immune to alien plant invasions. Fourqurean et al. (2009) explored the possibility that neotropical mangrove forests, with just four species, may be vulnerable to invasion by Old World mangrove species, where there are more than one dozen different species. Studies of cultivated plants by Dangremond (2015) revealed lumnitzera to be tolerant of a very wide range of environmental conditions. And Ye et al. (2004) showed that lumnitzera seeds exhibit true dormancy, unlike most other mangrove species. This last factor especially is a major stumbling block toward eradication since year after year, new seedlings appear in areas where eradication was thought to have been achieved. Currently, efforts are at the level of containment, however, there is hope that complete eradication of lumnitzera is not too far in the future. The success of the eradication efforts is attributed to close collaboration between stakeholders, availability of risk assessment tools, dedicated rapid response funding, management-relevant research, and sustained control efforts.

### Key Recommendations

- Continued aggressive monitoring and removal efforts should continue until lumnitzera is determined to be eradicated from Florida.
- Expanded, systematic monitoring for new species introductions is needed to increase the likelihood of early detection in the South Florida Ecosystem.
- The experiences and lessons learned from the lumnitzera eradication initiative provide valuable insight for future rapid response efforts toward other invasive species. After action analysis should be developed and used to improve regional rapid response partnerships.

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# South Florida Ecosystem Restoration Task Force

## Invasive Exotic Species Strategic Action Framework

### *Containment Case Study: Argentine Black and White Tegu*

The Argentine black and white tegu is a large lizard native to South America and popular in the pet trade, and several invasive populations are now established in the southeastern USA, including in southern Miami-Dade County. In their native range, tegus are habitat generalists and eat a wide variety of fruits, insects, small vertebrates, and specialize in eating the eggs of ground-nesting animals. Their high reproductive capacity, lack of potential predators, and adaptability to a wide variety of resources and environmental conditions make them a threat to Florida's wildlife and environment. From their current location in Miami-Dade County, tegus are dispersing west towards the sensitive habitats in Everglades National Park (ENP), south toward the Florida Keys, east towards Biscayne National Park and American crocodile nesting habitat at Florida Power and Light's Turkey Point power plant, and north into residential and agricultural areas. Since they are already widely established, the goal is to contain them to their current range and decrease the population size.

#### **Case Presentation**

A population of tegus was discovered in Florida City, a town just east of ENP, in 2008 by members of the Everglades Cooperative Invasive Species Management Area (ECISMA), an interagency group dedicated to cross-jurisdictional collaboration on invasive species management efforts. The following year, more investigation and limited trapping efforts confirmed that the tegus were breeding. There were no dedicated staff from any agency to initiate a rapid assessment and response effort at that time. The National Park Service (NPS) and Florida Fish and Wildlife Conservation Commission (FWC) were able to hire one trapper and redirect limited staff resources to develop trapping methods and track five telemetered tegus, including one female that led to the discovery of the first tegu nest in Florida. The stomach contents of tegus were analyzed to determine diet. During subsequent years, volunteer trapping efforts by more ECISMA partners enabled the continued assessment of tegus but did not appear to limit the expansion of the tegu population.

There was no dedicated funding for trapping efforts until 2011. Private trappers have also become involved with trapping tegus, and many of their captured tegus are re-sold into the pet trade. The exact number of tegus removed by private trappers and their ultimate fate is not available; nonetheless, the general number given by at least one trapper is that hundreds of individuals have been taken out of the wild and placed back into the pet trade. No permit is required to possess pet tegus in Florida at this time. People selling nonnative wildlife must have a valid License to Possess Class III Wildlife for Exhibition or Public Sale from FWC that authorizes the sale of Class III reptiles. Any sales to out-of-state entities must be conducted in compliance with any applicable federal or state rules.

From the first reports of tegus in 2008 in Florida City through 2019, the tegu population has continued to

#### The Tegu Curtain

The Argentine black and white tegu is a large, invasive lizard native to South America that has become established in southern Miami-Dade County. The goal is to protect sensitive habitats, including nearby national parks and crocodile nesting areas, by containing them within their current range and decreasing the population size.



Photo: Dennis Giardina.

grow and expand its range, despite increasing trapping efforts. Currently, tegus occur across over 100 square miles, including many natural areas and conservation lands. Despite being readily trappable, there is a consensus that eradication now appears unlikely, and containment is the appropriate objective.

### **Management Actions and Outcome**

After their discovery, ECISMA quickly coordinated tegu trapping and removal efforts following the group's rapid response protocol, though limited staff and financial resources prevented an aggressive response. Alongside the efforts to remove tegus from natural areas, this included public outreach to facilitate removals from private lands and research to assess tegu biology and impacts and improve management practices. These initial efforts, which began within two years of discovery, led to relatively rapid determination of effective trapping methods and confirmation that the tegu may represent a significant threat to wildlife. The University of Florida, Zoo Miami, South Florida Water Management District, and the U.S. Geological Survey began providing staff to trap and track tegus starting in 2011, with FWC providing staff specifically to support tegu removal in 2012. In 2013, the idea of creating a "Tegu Curtain" was proposed, which includes utilizing camera traps and driving surveys to monitor the perimeter of the population and conduct intensive trapping in core areas that would expand to correspond with seasonal dispersal. The U.S. Department of the Interior provided support for this effort and NPS provided additional staff and volunteers in the field. This containment effort, coordinated among many partners, was expanded in 2014 and has undergone incremental changes in subsequent years. Although each participating organization is contributing available resources, existing funding and staffing levels appear insufficient to meet the containment objective, as tegus are now regularly observed in areas that were unoccupied just four years ago. Tegus are now occasionally removed just inside ENP, though in low numbers and there is not yet evidence that tegus are

reproducing there. Nonetheless, the dedication and persistence of ECISMA members and cooperators has led to increased efforts and larger numbers of tegus removed every year, and the tegu population may well have been larger and more widespread without these efforts. The knowledge base about the species and control options and methods has also significantly improved, and this knowledge will be important to the long-term management of tegus.

### **Key Recommendations**

- Outreach to the public promoting early reporting can lead to more discoveries of newly established populations, possibly in time to contain further spread.
- Dedicated resources are needed to successfully respond, and resources must be consistent with the scale of the threat. Potentially significant threats warrant application of all available resources.
- Time is of the essence – developing methods and initial assessments should be quick, because incipient populations may grow rapidly, leading to larger costs and effort.
- Though the response to a newly established population should be quick, efforts may need to be sustained over multiple years to achieve eradication and future cost savings.
- A pre-existing coordination and decision-making framework among agencies, researchers, and partners would be helpful to expedite and improve the containment response.
- If containment of tegus is not possible, assessments should be conducted to quantify impacts and inform next steps and develop long-term strategies to protect key resources.
- Volunteer efforts are valuable, but dedicated staff are more effective.
- As invasive-animal populations move into long-term management, control efforts may shift from agency or university staff to contracted work, similar to how invasive plants are managed.

# South Florida Ecosystem Restoration Task Force

## Invasive Exotic Species Strategic Action Framework

### *Long-term Management Case Study: Burmese Pythons*

Burmese pythons are giant constricting snakes, native to Asia, that have established extensive populations in southern Florida. Adult pythons are large predators with little risk of predation themselves, and the Florida population has the potential to negatively impact a multitude of native wildlife species. This issue spans a vast area across south Florida and crosses geopolitical boundaries. Interagency collaboration and continued research and tool development are critical for successful management of this invasive exotic species.

#### **Interagency Coordination**

In 2016, the Florida Fish and Wildlife Conservation Commission (FWC) developed an Interagency Python Management Coordinator position with support from Everglades National Park to develop an Interagency Python Management Plan (IPMP). The first three years were spent sharing information from researchers and managers, determining which land managing agencies, tribes, and organizations would be included in the written plan development, and creating goals and strategies pertaining to python management. In 2019, the first interagency team meeting, including 15 partner agencies, tribes, and organizations, was held in Fort Lauderdale and an outline for what would be included in the IPMP was developed. The IPMP will center around identifying goals and management strategies among agencies and Cooperative Invasive Species Management Areas (CISMAs) to optimize resources, prioritize, and align management strategies and actions for Burmese pythons. To date, four meetings have been held with this interagency team and a full draft is expected to be finished by the end of 2020.

This interagency team uses a multi-faceted approach to control this invasive constrictor:

#### Prevention through Regulation

- The FWC listed the Burmese python as a Conditional species as of August 23, 2010, meaning that an individual can no longer acquire a Burmese python in the state for personal use.
- In 2012, the U.S. Fish and Wildlife Service (FWS) placed Burmese pythons on the injurious species list,

which prohibits the importation of this species from outside the continental United States without a federal permit.

- Since 2006, 114 Burmese pythons have been surrendered to the Exotic Pet Amnesty Program.
- The FWC signed Executive Order (EO) 20-17 in 20 that authorizes the lethal take of nonnative reptiles without a permit or hunting license requirement, including pythons, on 25 Commission-managed properties in south Florida. The FWC continues to look for opportunities to expand upon this EO and remove regulatory barriers for invasive species removal efforts.

#### Early Detection/Rapid Response to New Sightings

- FWC's Exotic Species Hotline receives reports from the public regarding nonnative wildlife.
- From 2015 to April 2020, this hotline received 469 calls about pythons. An additional 537 reports were submitted online and through the IveGot1 smartphone app.

#### Control Tools

- Expert human searchers: Visual searches by local experts continues to be the most effective means of detecting and removing pythons from the wild. The FWC and South Florida Water Management District (SFWMD) contractor programs have removed over 5,000 pythons from public lands since 2017. The National Park Service (NPS) has 69 authorized agents that remove pythons from NPS properties.
- Detection dogs
- eDNA
- Python specific traps
- Pheromone and other attractants
- Sentinel or scout snakes (telemetered animals)

#### Research

- Development and refinement of innovative tools and techniques to improve our ability to detect and remove pythons from the wild.

#### Public Engagement

- Python Patrol – Participants learn how to identify and safely capture pythons. To date, over 3,000 people have been trained at 215 workshops.
- Annual Python Challenge™ – The FWC and SFWMD conduct events that provide awards for the most and largest pythons captured. The 2020 Python Bowl removed 80 pythons in just 10 days.

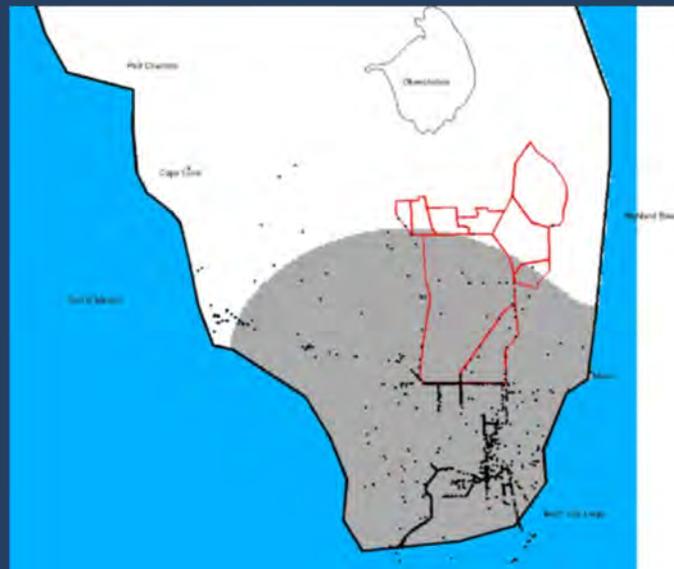
## The Role of Science in Long-term Management: The Burmese Python Structured Decision Making (SDM) Workshop

In June 2014, in response to the growing Burmese python threat to the Arthur R. Marshall Loxahatchee NWR (Refuge), the FWS and key stakeholders participated in a U.S. Geological Survey (USGS)-funded python Structured Decision Making (SDM) workshop at the FWS National Conservation Training Center (NCTC). Other agencies represented included the FWC, NPS, University of Florida, and USGS. The purpose of the SDM workshop was “to determine the most efficient allocation of resources for surveillance (detection with intent to eliminate the threat) and control (removal) activities in order to minimize ecological damage from pythons once they become established on the Refuge (Gibble et al. 2014)”.

A specific outcome from the workshop included the development of a predictive model that would determine the current location and expected arrival of the northward-moving python front to the southern end of the Refuge. The model predicted that the northward-moving python front was less than 20 kilometers from the Refuge and that pythons were expected to be established and breeding by 2020 (Bonneau et. al. 2016). In addition, numerous control actions and research tools were discussed or further refined. These included expanding the Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP) survey coverage, utilizing detection dogs and sentinel snakes, trap modifications with real-time monitoring capabilities, implementing additional mammal studies to monitor trends, and enhancing capture and monitoring training for agency staff.

In the end, a USGS-funded eDNA study (2014) confirmed the presence of python DNA in water samples collected on the Refuge. Subsequently, in 2016, a refuge law enforcement officer on routine night patrol ran over and killed a 10-foot Burmese python on the L-40 levee. It was the first documented Burmese python recovered on the Refuge following several unconfirmed reports.

## Predicting the Python: Modeling its Northward Expansion towards Loxahatchee NWR



Burmese python invasion front and proximity to the Refuge as generated by a reaction-diffusion model developed by Bonneau, Johnson, and Romagosa (2016) – an end product of the NCTC Inter-agency Loxahatchee Python SDM Workshop held in June 2014.

### Source (s):

Bonneau, M., Johnson, F., and C.M. Romagosa. 2016. Spatially explicit control of an invasive species using a reaction-diffusion model. *Ecological Modeling* 337: 15-24.

Gibble, R., Kapsch, M., Bonneau, M., Brandt, L., Hart, K., Irik, K., Ketterlin-Eckles, J., Klug, P., Mitchell, C., Olson, R., Romagosa, C., Waddle, H., Adams, A.Y., Hauser, C., Johnson, F., Brewer, D., and S. Converse. 2014. Management response to the threat of Burmese pythons in Arthur R. Marshall Loxahatchee National Wildlife Refuge: A case study from the Structured Decision Making Workshop, June 2 – 6, 2014, National Conservation Training Center, Shepherdstown, WV, 27 pp.

# South Florida Ecosystem Restoration Task Force

## Invasive Exotic Species Strategic Action Framework

### *Long-term Management Case Study: Lionfish*

Lionfish, predatory reef fish with venomous spines native to the Indo-Pacific, have invaded and established breeding populations in the waters off Florida. Since first observed off Florida in the 1980s, two lionfish species (*Pterois volitans* and *Pterois miles*) have populated the Caribbean, Gulf of Mexico, the Southeastern U.S. coastline, and the Bermuda coastline. Lionfish pose a threat to the integrity of the food web and are capable of impacting commercial fisheries, tourism, and overall coral reef health. Affecting a vast area and crossing geopolitical boundaries, continued interagency and partner collaboration and coordination are key to successful management of this invasive marine species.

#### **Challenges to Long-term Management**

Lionfish, a popular marine aquarium fish, represent the first invasive marine fish species establishing itself in the Western North Atlantic/Caribbean. The first lionfish sighting in the U.S. was in 1985, however, it wasn't until the early 2000s that they became established in the South Atlantic and 2010 when they became established in the Gulf of Mexico. As of May 20, 2020, the established range for invasive lionfish spans from Venezuela to North Carolina, however, lionfish sightings have been as far north as Massachusetts and as far south as Brazil. Lionfish can withstand low salinity and a wide range of temperatures for long periods of time, which may result in more sightings within the Everglades region. Lionfish have already been found in the more brackish waters of the Loxahatchee River, St. Lucie River, some inland canals, the Florida Intercoastal Waterway, and Florida Bay within Everglades National Park.

Lionfish have few predators and represent a threat to native fish species, many of which have economic importance, in addition to those that have ecological importance by helping keep our reefs clean, allowing for coral recruitment. Lionfish also reproduce rapidly. Sexually mature within one year, lionfish can spawn as often as every four days, year-round, with a larval sac that floats on the currents and can survive approximately one

month. Combatting this ever-growing invasion requires effective interagency coordination and multiple management approaches.

#### **Management Strategies**

Removal studies have shown that regular, targeted removals of lionfish are successful. Fortunately, while having venom in their spine, lionfish are not poisonous to eat, providing another avenue for removal. Current management strategies include strengthening (and easing some) regulations, targeted removal, and public engagement.

#### Prevention Through Regulation

- Strengthening regulations on importation and breeding: In 2014, the Florida Fish and Wildlife Conservation Commission (FWC) prohibited the importation of live lionfish into Florida, the intentional breeding of lionfish in captivity in Florida, and the

#### An Invasion Below

Since first observed in the 1980s, two predatory species of lionfish have populated the Caribbean, Gulf of Mexico, the Southeastern US coastline, and the Bermuda coastline.



Photo: Cory Walter, Mote Marine Laboratory.

harvest or possession of lionfish eggs or larvae in Florida for any purpose other than destruction. Two lionfish have since been surrendered to the FWC Exotic Pet Amnesty Program.

- Easing of state and federal regulations to allow more lionfish harvesting. Some of these measures include the State of Florida removing size and bag limits for recreational or commercial harvest and the National Oceanic and Atmospheric Administration (NOAA) Office of National Marine Sanctuaries (ONMS) issuing permits to allow spears in sanctuary no-fishing zones to specifically harvest lionfish.

#### Response and Control Plans

- Multiple plans have been developed to address lionfish, including the Intergovernmental Aquatic Nuisance Species Task Force National Invasive Lionfish Prevention and Management Plan, FWC's Lionfish Control Plan, NOAA's ONMS Lionfish Response Plan, and NOAA's Invasive Lionfish Action Plan.

#### Control Tools and Long-Term Management

- Targeted removal efforts are conducted by the National Park Service (NPS), FWC, NOAA ONMS, and Mote Marine Laboratory.
- The commercial and recreational harvest of lionfish is ongoing, encouraged by the "Eat 'em to Beat 'em" campaign.
- Lionfish derbies and tournaments are conducted by multiple agencies and entities. The FWC provides monetary assistance for tournaments that remove lionfish.
- Removal Incentive Programs: FWC "pays back" charter fishermen and/or dive shop expenses for trips that are specifically completed as lionfish harvest and education trips. FWC also allows an additional spiny lobster over the recreational season bag limit if 10 or more lionfish have also been removed.

#### Research Support

- Many federal and state grants provide for lionfish research.
- Lionfish specific trap development research ongoing.

### Juvenile Lionfish

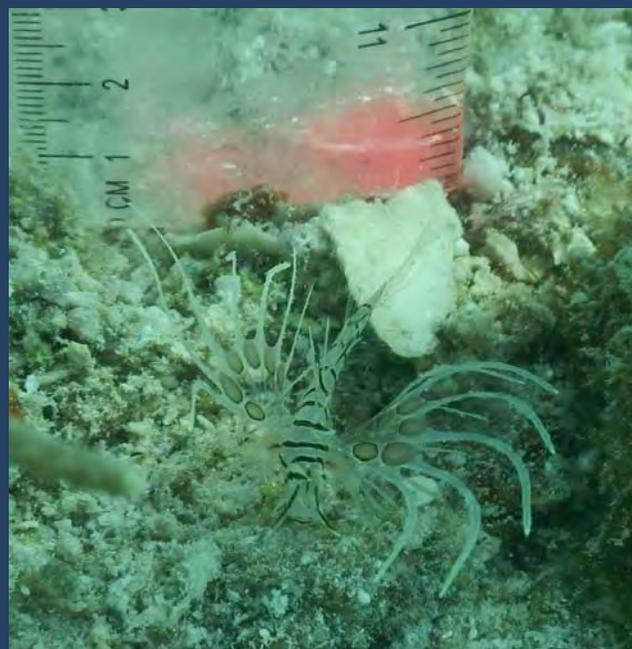


Photo: Kelli O'Donnell, NOAA Fisheries.

- NOAA Fisheries and ONMS completed a Programmatic Environmental Assessment in 2018 that allows for the testing of various trap types and design modifications across multiple areas to determine their effectiveness at catching lionfish in the Gulf of Mexico and South Atlantic, including within the Florida Keys National Marine Sanctuary.

#### Public Engagement and Targeted Recreational Removal Efforts

- The FWC and other agencies conduct public outreach and recreational removal events targeting lionfish. These include FWC's Lionfish Removal and Awareness Day, Lionfish Challenge, "Become the Predator" workshops, Lionfish Classroom Invasion, Reef Rangers program, and Lionfish Summit Workshops. The NOAA ONMS also hosts a Lionfish Invitational.
- Citizen scientists are also engaged in reporting lionfish sightings to the US Geological Survey, NPS, and FWC.

# South Florida Ecosystem Restoration Task Force

## Invasive Exotic Species Strategic Action Framework

### *Long-term Management Case Study: Invasive Plant Coordination and Funding*

Combatting established invasive plants requires achievement of maintenance control through sequential control efforts, long-term resource commitment, and extensive interagency coordination. Currently, there are 80 invasive plant species within the South Florida Ecosystem that are priorities for control (SFWMD 2020). Due to the complexities of implementing landscape-level control strategies across numerous jurisdictions, local, state, and federal agencies are working closely in the South Florida Ecosystem to coordinate efforts and improve our collective ability to achieve maintenance control of these priority invasive plants.

#### **Maintenance Control**

Management for widely established invasive plant species typically begins with controlling small incipient populations and then moves toward the most heavily infested habitats. As control efforts proceed, retreatment is invariably needed due to regrowth from seed banks and other propagule sources. As the number of sequential control efforts increases for an area, the slower the regrowth and spreading of the invasive plant. Control techniques are utilized in a coordinated manner on a continuous basis in order to maintain invasive plant populations at the lowest feasible level. This method of invasive plant management is known as maintenance control.

#### **Challenges to Achieving Maintenance Control**

Coordination and collaboration are critical for natural resource managers due to the large number of invasive plant species, vast and remote natural areas, and numerous jurisdictions within the South Florida Ecosystem. The maintenance control strategy, first described in Florida's Exotic Pest Plant Council's (FLEPPC) 1990 Melaleuca Management Plan, is used by most natural resource managers in Florida today. Ideally, this control process should progress across the landscape in a systematic manner, but varying resource availability for control across jurisdictions and untreated infestations on adjacent private lands present challenges. In addition, short term deviations from the strategy are sometimes neces-

sary to protect critical natural resources (e.g., endangered species). Another obstacle to achieving maintenance control is simply the magnitude of infestations that cover thousands to tens of thousands of acres.

#### **Planning for Maintenance Control**

Most agencies in the South Florida Ecosystem have developed individual conceptual plans for their management areas and, through decades of collaboration, have developed statewide species-specific management plans for the most problematic invasive plant species. Basic principles for a sound strategy include:

- Reserve adequate resources for follow-up control at the most cost-effective interval;
- Follow a containment plan (i.e., systematic inward progress across the landscape);
- Address "triage" needs for rapidly expanding infestations that are not scheduled for treatment but threaten conservation priorities (e.g., threatened and endangered species); and
- Seek maximum efficiency through integrative management that combines chemical, mechanical, cultural, and biological control methods.

Every strategy should also consider how a specific infestation fits into the conservation landscape and what opportunities are available to collaborate with other agencies on a regional level. This regional approach encourages individual managers to cooperate on funding proposals that will provide multiple benefits. Through ongoing collaboration with the Florida Fish and Wildlife Conservation Commission's (FWC) Invasive Species Regional Working Groups, the Everglades Cooperative Invasive Species Management Area (ECISMA), FLEPPC, and other partnerships, agencies in south Florida coordinate invasive plant management activities such as:

- Developing integrated weed management techniques to ensure cost-effective and environmentally sound practices;
- Using innovative procurement specifications to improve cost-efficiency;

- Integrating an adaptive response to events such as wildfires, droughts, hurricanes, and extreme flooding; and,
- Funding research on effective and safe herbicides and biological control agents.

### **Consistent Funding for Maintenance Control**

Despite advancements made toward achieving maintenance control statewide, many of South Florida's largest conservation lands have not reached the maintenance control phase for all 80 priority invasive plants. Several factors explain this deviation from the state-wide trend: large, inaccessible landscapes, aggressive subtropical invasive plants, and inconsistent or insufficient funding. While the large spatial scale faced by natural resource managers is unchangeable, strategies to address resource limitations have emerged. Past efforts relied on natural resource managers requesting funds for invasive plant management on individual sites, with the amount of money received determining what could be accomplished in a given year. This minimal, often non-recurring, funding model did not result in cost-effective or sustainable success. In the recent past, federal management funding continually decreased. State funding fluctuated, but to a lesser degree. Sustained funding, even when insufficient, allows development of a long-term treatment strategy. For large conservation lands where infestations are significant, landscape-level planning and continuous, sufficient funding are paramount.

One method to overcome the lack of sufficient recurring funds is to form cost- and resource-sharing cooperative agreements between land managing agencies. Such agreements can include the sharing of personnel, equipment, chemicals, biocontrol agents, computer technology, inventory and monitoring data, and educational materials. Cooperators also share the knowledge and skills of available experts and technicians, sponsor joint training, and convene technical workshops and informational meetings. Successful cooperative agreements also help to reduce parochial conflicts and institutional barriers

that limit the most efficient use of public management resources.

In south Florida, federal, state, and regional agencies do cooperate and combine resources. The FWC, South Florida Water Management District (SFWMD), U.S. Fish and Wildlife Service, National Park Service, Florida Forest Service, and Florida Park Service have collaborated on operational management and funding of single and connected conservation lands. This collaboration has resulted in the successful maintenance control of millions of acres of invasive plant species.

### **Key Recommendations**

Achieving maintenance control of priority invasive plant species is a priority for all agencies responsible for invasive species management in the South Florida Ecosystem. To that end, here are some key recommendations:

- Allocate sufficient resources to invasive plant programs to ensure agencies can achieve and maintain maintenance control rotations.
- Continue close coordination and technology exchange to maximize program optimization.
- Conduct research to improve control tools for natural area invasive plant management and maximize integrated pest management strategies. Key areas of research include herbicide evaluations and new biological controls.
- Review procurement strategies to ensure competitive pricing for contractual services while maintaining high standards for work in sensitive natural areas.
- Expand incentives for invasive plant management on private lands to reduce off-site sources of re-infestations on public lands.

### **Resources**

FLEPPC Melaleuca Management Plan: [https://www.fleppc.org/Manage\\_Plans/mplan.pdf](https://www.fleppc.org/Manage_Plans/mplan.pdf)

SFWMD 2020 South Florida Environmental Report: [https://apps.sfwmd.gov/sfwmd/SFER/2020\\_sfer\\_final/v1/chapters/](https://apps.sfwmd.gov/sfwmd/SFER/2020_sfer_final/v1/chapters/)



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**[EvergladesRestoration.gov](http://EvergladesRestoration.gov)**