

Conclusions and Recommendations

EIRAMP has removed more than 1,800 nonnative and invasive animals from the Everglades and has likely prevented new populations from establishing. The program contributes scientific data on life history, location, habitat use, and impacts to help develop control tools and determine priorities in a funding-limited environment. Methods are cost-effective and continuously evaluated and improved in an adaptive framework.

This five-year synthesis of EIRAMP's accomplishments leads us to the following recommendations:

- Continue surveys and data analyses to detect trends in occurrence and impacts.
- Conduct taxa-specific surveys.
- Expand surveys geographically and temporally to assess potential impacts of Everglades restoration projects.
- Maintain a core staff of professionally trained biologists.
- Continue a carefully managed volunteer program.
- Integrate EDRR with targeted outreach.
- Perform necropsies on removed specimens to maximize data collection at minimal cost.
- Continue rapid *and persistent* response to reports of new species in new locations.
- Continually evaluate and adapt the program to increase efficiency and return on investment.
- Secure a dedicated and sustainable source of program funding.

How You Can Help EIRAMP

Everyone can help report nonnative species! If you see a nonnative animal or plant in south Florida:

1. **Take a picture.**
2. **Note the location.**
3. **Report the sighting.**

How to report a sighting:

1. Call the FWC's Exotic Species Hotline: **888-Ive-Got1** (888-483-4681).
2. Report online: **IveGot1.org**.
3. Download the **IveGot1 app**: Free for smart phones and tablets.

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<http://crocdoc.ifas.ufl.edu>

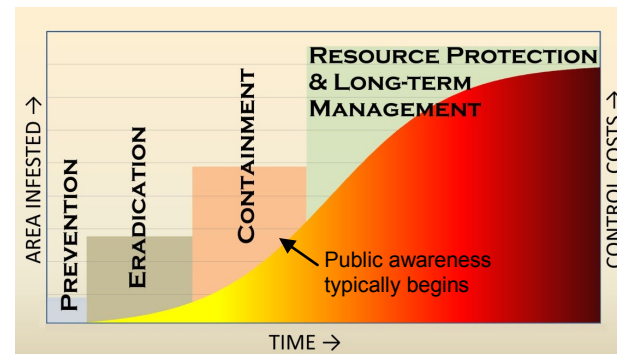


Figure 1. The invasion curve. Adapted from Invasive Plants and Animals Policy Framework, State of Victoria, Australia, Department of Primary Industries, 2010.

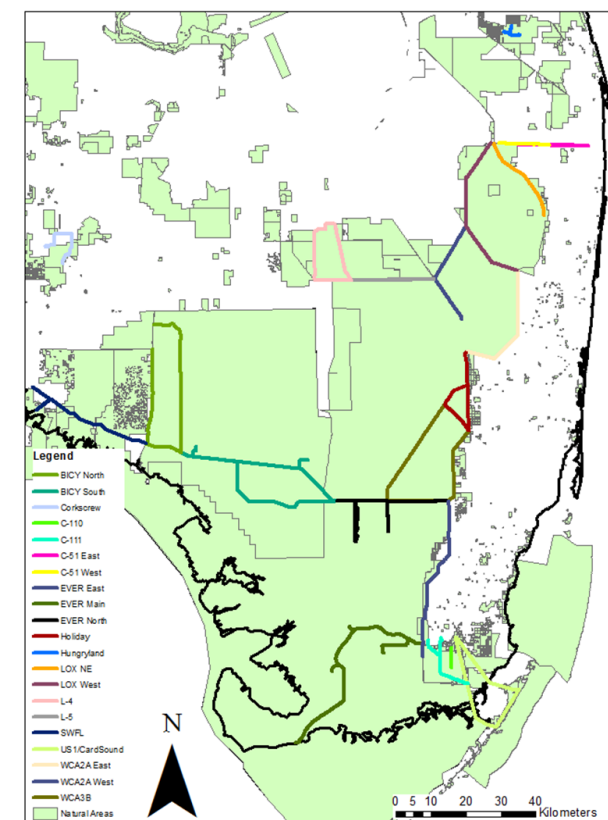
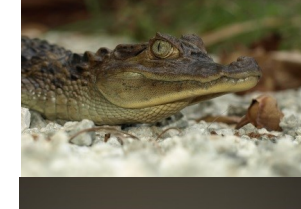


Figure 2. Map of EIRAMP routes in south Florida with natural areas shaded in green.

Everglades Invasive Reptile & Amphibian Monitoring Program



South Florida has more nonnative species of reptiles and amphibians than anywhere else in the world. Some of these species become *invasive* and harm the environment, economy, and/or public health. Many are predators that can severely impact native species and ecosystems. Controlling and monitoring these invaders are essential to the success of multi-billion dollar Everglades restoration efforts.

Prevention and eradication are the most cost-effective ways to limit impacts of invasive species (see Figure 1 on back page). Once populations are widely established, management becomes expensive, long-term, and often ineffective. Early detection and rapid response (EDRR) offers the best chance to get ahead of the invasion curve and successfully contain or eradicate populations while they are still localized.

Everglades Invasive Reptile and Amphibian Monitoring Program

The Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP) provides a scientific framework for integrated EDRR, outreach, and monitoring for invasive reptiles and amphibians in south Florida. EIRAMP also monitors native reptiles, amphibians, and mammals to assess impacts of invasive species.

University of Florida has operated EIRAMP since 2010 in collaboration with partners in the Everglades Cooperative Invasive Species Management Area (ECISMA). Funding has come from South Florida Water Management District, Florida Fish and Wildlife Conservation Commission, US Geological Survey, and US Fish and Wildlife Service.

EIRAMP Objectives

- Determine the status and spread of existing populations of nonnative reptiles/amphibians, and occurrence of new populations.
- Provide early detection, rapid response, and containment capability for removal of nonnative reptiles/amphibians.
- Evaluate status and trends of populations of native reptiles, amphibians, and mammals.
- Synthesize results in an adaptive framework to enhance removal of invasive species and to determine impacts of invasive species on native wildlife assemblages.

EIRAMP Activities (2011–2015)

- More than 1,800 nonnative animals removed
- 1,505 surveys of 22 routes (Figure 2)
- 197 opportunistic surveys
- More than 100,000 trap nights (live traps and camera traps)
- 1,410 necropsies of 11 species
- 5,670 site surveys and 496 person-hours of walking surveys for detection estimates
- Rapid response to 33 nonnative reptile reports



University of Florida biologist Mike Rochford with captured Nile crocodile (*Crocodylus niloticus*).

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Brown anole © Thomas Brown; Nile monitor © Bill Bayless; veiled chameleon © Joshua David Holbrook; northern curly-tailed lizard © William Flaxington



EIRAMP Accomplishments 2011–2015

Nonnative Species Removal

Early Detection & Rapid Response

EDRR accomplishments include responding to new introductions and to reports of established species in new locations:

- We responded rapidly and persistently to sightings of a Nile crocodile in southwestern Miami-Dade County, finally removing the crocodile after a two-year chase. This was the last known sighting of this species in the wild in Florida.
- We responded to an EDDMapS report of a panther chameleon in a natural area in Broward County. Subsequent surveys suggested that the population has been eradicated. We also removed six veiled chameleons from close to the Arthur R. Marshall Loxahatchee National Wildlife Refuge in Palm Beach County.
- A two-year pursuit of Nile monitor lizards ended after we distributed door hangers in Southwest Ranches, Broward County. This targeted outreach led to removal of a Nile monitor and identification of others in the area.

Containment and Management

EIRAMP contributes to the “containment” and “long-term management” stages of the invasion curve by continually removing established species. In total we have removed 147 Burmese pythons, 942 Argentine black and white tegus, 14 Nile monitors, 600 Oustalet’s chameleons, and 94 spectacled caimans.



Panther chameleon (*Furcifer pardalis*).
Credit: Pat Howell, Broward County Parks



Nile monitor (*Varanus niloticus*) in trap.

Scientific Contributions

Presence and Detectability

- We documented the presence of 75 native and 28 nonnative species (15 reptiles, 3 amphibians, and 10 mammals). 64% of all reptiles encountered, 30% of amphibians, and 24% of mammals were nonnative.
- We estimated Burmese python detection probability at **0.005%**. Once a python is detected, we estimated capture probability at **98%**.
- We tracked expansion of Burmese pythons based on occurrence on survey routes. We are continuing to document a relationship between presence of pythons and absence of mammals.

Impacts

- A camera trap documented tegus removing eggs from the nest of an American alligator. Tegus were also observed on an American crocodile nest but without evidence of depredation.
- Necropsies revealed prevalence of small mammals and reptile eggs in the diet of tegus, reptiles in the diet of Nile monitors, and insects in the diet of Oustalet’s chameleons.
- Necropsies also provided evidence of high fecundity (large number of eggs) of invasive reptile species. Data on reproductive condition can be used to model population growth.



Argentine black and white tegu (*Salvator merianae*) removing an alligator egg from a nest.



University of Florida biologists conducting a necropsy of a Burmese python (*Python molurus bivittatus*).

Management Lessons

Professional Biologists

A special combination of skills is required to capture cryptic, elusive, and potentially dangerous wildlife, and to collect scientific data. Maintaining a core trained staff is essential to program success.



University of Florida biologist Michiko Squires with a captured Burmese python.

Well-Managed Volunteers

Knowledgeable volunteers can be effective at removing Burmese pythons in areas not open to the public. Managing and providing incentives to volunteers has proven less expensive than other python removal methods.



University of Florida and partners responded rapidly and persistently to sightings of a Nile crocodile. The animal was removed using block nets.

Rapid and Persistent Response

EDRR programs have to be persistent as well as rapid. Our success with Nile crocodiles and Nile monitors demonstrated the effectiveness of persistence.



University of Florida biologist Mike Martin tracking a telemetered tegu. Radio tracking is used to estimate detection of pythons and tegus.

Improving Detection

Finding Burmese pythons (not catching them) is the limiting factor for python removal. To improve detection, we recommend surveying during the warm part of the day for adults in the cool months, and at night for adults and hatchlings in warm months. Optimal conditions are warm, humid, calm days.



Outreach door-hanger that led to the removal of a Nile monitor in Southwest Ranches, Florida.

Targeted Outreach

Engaging local residents and workers through targeted outreach can enhance EDRR programs in human-dominated landscapes.