CISMA
Everglades Cooperative Invasive Species Management Area

# Newsletter

VOLUME 13 2023-24

*Volunteer from the Ft. Pierce Tegu Trapping Project in St. Lucie County.*

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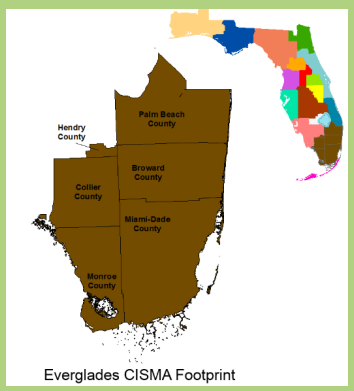


Everglades CISMA Footprint

# Florida Fish and Wildlife Conservation Commission's Nonnative Volunteers: Helping Conserve Florida's Ecosystems

*By: Zachary Chejanovski, Daniel Young, and Shelby Stanley, Florida Fish and Wildlife Conservation Commission*

Volunteers play a crucial role in the conservation of Florida's native ecosystems by assisting the Florida Fish and Wildlife Conservation Commission (FWC) and partners with the control of nonnative and invasive species. Two invasive species that are a major ecological threat to Florida ecosystems are Burmese pythons (*Python molurus bivittatus*) and Argentine black and white tegus (*Salvator merianae*). The need for control of pythons and tegus is high due to their generalist diets causing negative impacts on native species. Additionally, land managers have difficulty controlling these species due to the vastness of the environments invaded and the species' low detectability. FWC volunteers help with expanding control measures and removal projects for pythons and tegus.

FWC python volunteers are initially trained in the identification, handling, and safe capture of pythons. This training prepares volunteers to assist staff with visual python surveys on foot or by vehicle. FWC also holds large outreach events, such as the Florida Python Challenge®, during which volunteers assist at Challenge check stations providing guidance to participants.

FWC tegu volunteers are trained in the deployment and monitoring of live capture traps operated on removal traplines. Since the fall of 2022, FWC volunteers have maintained three traplines as part of a tegu removal project in Ft. Pierce, Florida, removing 876 tegus in total. Before volunteer assistance on this project, the trapline could not be implemented regularly, limiting the number of tegus that could be removed.

An additional avenue for the public to help FWC mitigate the impact of pythons, tegus, and other nonnative or invasive

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# FWC's Nonnative Volunteers: Helping Conserve Florida's Ecosystems (CONTINUED FROM PAGE 1)

species is to become a FWC Early Detection Rapid Response (EDRR) volunteer. Nonnative animal sightings are continually reported to FWC through the Invasive Species Hotline (1-888-IVEGOT1), the IveGot1 app, or IveGot1.org. FWC relies on a state-wide network of EDRR volunteers to capture and remove reported nonnative animals. Individuals interested in signing up to be an FWC EDRR volunteer, python volunteer, or tegu volunteer should contact Daniel Young at Daniel.Young@MyFWC.com.

# A New *Hyparrhenia* in South Florida

*By: Jimmy Lange, Fairchild Tropical Botanic Garden*

Let me start by saying that *Hyparrhenia* is a genus of grasses native to Africa that do not belong in South Florida ecosystems. With that in mind, I hope the reader will indulge my recent experience studying new material I came across in southwestern Broward County. Whilst driving north on US-27 in early August in this, the year of our Lord, 2023, I noticed a small (~3 m radius), circular stand of a large, glaucous (grayish blue-green) grass in the roadside swale. The color and size of the grass was in stark contrast to the small stature, dark green surface of the oft-mowed area surrounding it. With my inflated sense of duty as a graminologist superseding my responsibility as a motor vehicle operator, I immediately pulled onto the shoulder and went to investigate. The material was sterile, i.e. not flowering or fruiting, so I inspected the vegetative characters available.

*(Left) Small, circular stand of H. hirta at a distance. (Right) Closer view of habit and stature of sterile plants.*

The plants stood roughly 0.5 m tall, with long (up to 50 cm), narrow, glabrous leaf blades. The margins of the blades were harshly scabrous, and would likely cut skin, and they possessed a distinct white midvein. Working toward the base on the leaf, or the collar, I noticed a relatively large (4 mm), membranous ligule, and a yellowish hue in that region. Examining the sheaths, or the portion of the leaf that clasps the stem, I noticed these were glabrous as well. Toward the base of the plant, it was clear that the individual shoots were connected by densely packed rhizomes.

*(Left) Narrow leaves with prominent white midvein. (Middle) Small, membranous ligule. (Right) Scabrous leaf margins.*

I revisited the area in late September, and this time found a single flowering culm, which upon close inspection led me to the genus *Hyparrhenia*. *Hyparrhenia* is closely related to and superficially resembles *Andropogon*, both have "Y-shaped" paired racemes throughout the inflorescence. A brief tangent is required to explain the keyway in which they differ. The individual units of these grasses (that may to some superficially appear as seeds) are known as spikelets. Both genera always have spikelets arranged

*(Left) Flowering culm displaying "Y-shaped", paired racemes. (Right) Closer view of single raceme pair displaying the spatheole, a leaf-like structure present beneath each raceme pair.*

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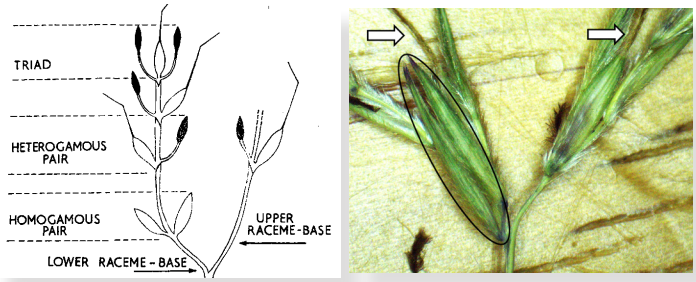
# A New Hyparrhenia in South Florida (CONTINUED FROM PAGE 2)

in pairs, one sessile on the branch and another on a small pedicel. In *Andropogon*, all spikelet pairs are heterogamous or appear slightly different in form. In *Hyparrhenia*, there is always at least one homogamous pair at the base of the raceme branch. After finding the homogamous pair at the base of the raceme branch, I knew I was dealing with *Hyparrhenia*. Visiting again in November, most of the plants were now fully mature, with flowering culms robust and roughly 2 m in length, with some as long as 3 m! This is the typical late-season flowering time of *Hyparrhenia*.




*(Left) Diagram of raceme structure from Clayton 1969. Note that awns are present on sessile spikelets, while lacking on pedicillate spikelets (black) and the homogamous pair at the base. (Right) Close-up of Florida H. hirta, displaying homogamous pair (outline) and heterogamous pairs ascending the raceme branches (note arrows pointing to golden awns projecting from sessile spikelets).*

*H. rufa* has long been present in Florida, but this species does not possess glaucous, scabrous leaves, so I suspected this was something new. The Flora of North America has a key to two species, *H. rufa* and *H. hirta*, separated by the color of hairs on the spikelets, with *H. rufa* possessing rufous, or rusty reddish hairs, and *H. hirta* possessing white to dark yellow hairs. Easy enough. My spikelets had mostly white hairs, with some appearing golden-yellow.

*(Left) Spikelets of H. rufa displaying rufous pubescence (photo credit: R. Mears 1989, Collier County). (Right) Spikelets of H. hirta displaying golden-yellow pubescence.*

There are currently 56 accepted species of *Hyparrhenia* globally, so I investigated further in case other species were being overlooked in our key. I went to the definitive source on the genus, "A Revision of the genus *Hyparrhenia*" authored by the recently deceased W.D. Clayton in 1969. For this work, for which he was awarded his PhD, Clayton traversed the continent of Africa and examined hundreds of herbarium specimens from around the world. Needless to say, he likely possessed the most intimate understanding of the genus. He stresses throughout the work the plasticity and diversity within the group that makes strict species boundaries often difficult to nail down. He states, "taxonomic difficulties probably stem from the fact that polyploidy, apomixy, and introgressive hybridization seem to be a common phenomena in *Hyparrhenia*…".

Using Clayton's key and detailed species descriptions, I was surprised that this new Florida material was not consistent with anything he described. For one, he did not describe yellow hairs for *H. hirta* or for that matter any species in the broader Hirta clade. Further, he described *H. hirta* with "flowering culms wiry, typically 30-60 cm high (1 m or more in exceptionally robust plants), standing over a dense leafy tussock 10-20 cm high." As I mentioned earlier, our plants have robust flowering culms 2-3 m high and do not contain the short, leafy tussock, and rather have cauline leaves to 1.5 m tall on sterile material. Confounding still, he notes the habitat as "dry soils… particularly in highland regions", where our plants are known so far only from wet roadside swales in Florida. For a litany of reasons I'll spare the reader, no other species matches the description of this Florida material. Thus, I tentatively apply *H. hirta* to this material and have been reaching out to other regions and experts without a definitive answer, though with a general consensus that this is most likely a form of *H. hirta*.

*Alan Franck (~2 m tall) having a nap beside flowering H. hirta.*

In keeping an eye out for this species, be aware of other large, glaucous grasses that may be observed in the wetlands of South Florida. The species that may superficially resemble *H. hirta* in size and general habit would be two *Andropogon* species. *A. virginicus var. glaucus* and *A. glomeratus var. glaucopsis*. Most simply, these species lack the scabrous margins, so feeling the leaves would be most useful, but also lack a prominent white midvein. One could also compare the flattened bases characteristic of most *Andropogon*, and as stated above the *Andropogon* taxa would lack the homogamous spikelet pair. *Hyparrhenia* = bad. Happy hunting!

*Literature cited:*

*Clayton, W. D. 1969. A revision of the genus Hyparrhenia. Kew Bulletin Additional Series II. London*

# Invasive Conehead Termites: Observed Impacts to Natural Areas and Native Trees in Florida

*By: Sue Alspach[1], Barbara L. Thorne[2], Katherine E. Tenn[1], and Marah S. Clark[1]*

*[1]Florida Department of Agriculture and Consumer Services*
*[2]Department of Entomology, University of Maryland*

The Florida Department of Agriculture and Consumer Services (FDACS) provided an overview of impacts from conehead termites (*Nasutitermes corniger*) infesting Florida's natural areas in the 2022 ECISMA newsletter. Influences of introduced coneheads to natural areas and trees have not been studied rigorously, but field observations of the Broward County populations in a variety of habitats reveal insights into substantial impacts. This article details some of those observations and the resulting consequences of invasive conehead termite infestations in natural areas and native trees.

*Conehead termites infesting a tree branch and closeup of a soldier with distinctive head shape.*

## Altering Decomposition Ecology

No other wood-destroying organism (beetle, fungus, or other termite) in South Florida forests ingests dead wood and leaf litter as fast as a thriving colony of invasive conehead termites. The high density of nests (50 per acre in the Broward County mangrove forest) filled with large, hungry populations (hundreds of thousands of individuals per nest) significantly increases the rate of decomposition compared to natural dynamics in South Florida natural areas.

## Consumption of Trees

In March 2022, ECISMA partners removed dead wood from the heavily infested Broward County mangrove forest to (1) reduce conehead termite food and harborage, and (2) inspect patterns of conehead damage to tree species (FDACS 2022). Extensive infestation by conehead termites was found in dead trunks and branches of all tree species removed from the forest including red mangrove (*Rhizophora mangle*), white mangrove (*Laguncularia racemosa*), Australian pine (*Casuarina equisetifolia*), and sabal palm (*Sabal palmetto*).

Nearly every piece of dead wood removed showed signs of substantial destruction and often heavy consumption from conehead termites. Dead tree interiors had been consumed

*Examples of the types of internal wood damage that was observed in the removed trees.*

to the point of completely hollowing out a trunk, with the entire cavity (including 20 ft tall tree trunks) often filled with nest cartons hosting an active colony.

Conehead termites were the most prevalent termite (and infestation damage) in wood removed from the mangrove forest. There was some dry wood termite damage. A few instances of small Coptotermes termite populations have been seen in this mangrove forest but none during the dead tree removal project.

Extensively infested dead heartwood within live trees has also been observed in the mangrove forest, frequently with foraging tunnels and nest cartons popping out of scars along mangrove tree trunks and main branches.

## Effects on the Growth of Native Palm Trees

Saw palmetto (*Serenoa repens*) is

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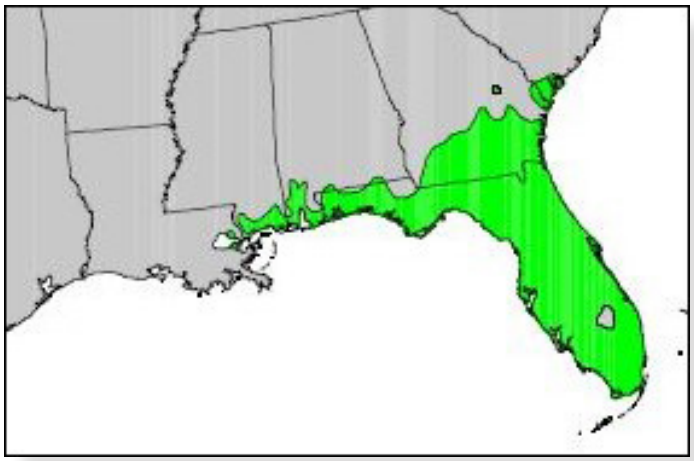
# Invasive Conehead Termites: Observed Impacts to Natural Areas and Native Trees in Florida (CONTINUED FROM PAGE 4)

a species of palm that grows nowhere else in the world other than in the southeastern United States. Important to wildlife in Florida, saw palmetto provides food or shelter to panthers, bears, birds, butterflies, moths, caterpillars, and a host of other insects. "If saw palmetto is not the plant species most highly used by Florida wildlife, it certainly is in close contention for that honor" (Maehr and Layne 1996). Unfortunately, conehead termites like saw palmetto too.



*Saw palmetto distribution – U.S. Forest Service/U.S. Department of Agriculture.*

A lively conehead termite nest was built on a young saw palmetto in an infested wetland in Broward County. The nest completely engulfed the palm's heart — the tree's apical meristem or growing point. Nests have also been found on the hearts of several sabal palmetto trees.

The long-term effects of coneheads on the palms are unknown because FDACS's eradication program immediately destroyed the nests. However, observations of points of nest attachment on other trees consistently show consumption damage. It is a reasonable conclusion, therefore, that a conehead termite nest, with its large population, sitting upon the apical meristem of a palm tree will have deleterious impacts.

*Conehead nests in hearts of palm trees; (Left) Saw palmetto, (Right) Sabal palmetto.*

**Importance of Eradication**

Invasive conehead termites have an exceptionally broad diet and can thrive in a wide range of habitats. In Florida, they have attacked wooded, riparian, estuarine, mangrove, and grassy natural areas as well as urban structures and landscapes. They are, therefore, a high concern for damaging other natural areas such as the Everglades if they spread further. Years of observing extensive conehead termite damage in diverse habitats of Broward County underscores the importance of eradication. With only approximately ten acres in Florida known to harbor live invasive coneheads, successful treatment protocols available, and enthusiastic staff on board,

*Literature cited:*

*Maehr, D. S. and J. N. Layne. 1996. Florida's All-Purpose Plant the Saw Palmetto. The Palmetto Fall 1996.*

*FDACS. Wetland W-6 Dead Tree Removal Project Summary. March 2022.*

# Invasive Ferns and Their Rare Native Lookalikes

*By: Emily Guinan, Fairchild Tropical Botanic Garden*

When a highly invasive fern species is found invading a habitat where another native and endangered fern species is growing, and both species happen to look extremely similar, treatment can prove to be difficult. Things become even more complicated when numerous other endangered and rare fern species are also occurring there, in and amongst the invasives. Such was the case at Fern Forest Nature Center in Broward County, a natural area home to over 15 species of rare ferns and many other rare plant

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# Invasive Ferns and Their Rare Native Lookalikes

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species. Most of these rare fern species are not known to occur anywhere else in the County, with Fern Forest having a unique mix of swamp, hammock, and limestone outcroppings that provide suitable habitat in an otherwise highly developed area. This limited habitat is further threatened by invasive plant species, and in particular, invasive ferns that directly displace the rare native ferns.

*The lookalike ferns, invasive T. incisa on the left and the native T. heracleifolia on the right. The two species are variable and have very similar appearances, making it difficult to differentiate them; key identifying characteristics include: T. incisa's more prominent secondary veins and deeply incised basal pinnae (hence its Latin name 'incisa') and T. heracleifolia's more tapered frond tips and shinier surface (photo credit: Elena Suarez, Broward County).*

The incised halberd fern (*Tectaria incisa*) is designated a Category I invasive species by the Florida Invasive Species Council (FISC). At Fern Forest, it grows densely in areas occupied by other rare ferns, including the state-threatened broad halberd fern of the same genus (*Tectaria heracleifolia*) and the state-endangered Florida tree fern (*Ctenitis sloanei*). Because of the proximity to these rare ferns (they often grow immediately above and around them), chemical treatment is not an option. Smaller efforts to hand-pull *T. incisa* have had limited success, and the species was often able to recolonize these areas more quickly than the native ferns were.

As part of our work with Broward County Park's Rare Plant Program, Fairchild Tropical Botanic Garden organized a large-scale effort to remove these invasive ferns and other invasive species from rare plant habitat. Beginning in the summer of 2022, we hosted workdays with volunteers from

*(Left) A photo monitoring point before and (Right) two months after removal of invasive T. incisa. A large amount of understory habitat was restored with our invasive removal efforts. Existing state-endangered C. sloanei visible in the bottom right of image 2, and additional rare ferns were planted in the clearing.*

the U.S. Department of Agriculture's Invasive Plant Research Lab (USDA IPRL) and the University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS) Master Gardeners program, as well as staff from Broward County and Fairchild. Over the course of two days, we managed to pull over 130 bags of *T. incisa* and other invasive plant species from the rare fern habitat. Due to the proximity and extreme similarity between *T. incisa* and *T. heracleifolia*, botanists from Fairchild helped to ensure that the correct (invasive) species was being pulled. Smaller follow-up workdays have kept these areas relatively clear of invasives and have opened a large amount of habitat for rare and native species.

*Volunteers from USDA IPRL posing with author in front of a portion of the bagged T. incisa we pulled from rare fern habitat at Fern Forest. From left: Stephanie Ripsom, Andrea Carmona Cortes, Sam Scherneck (in back), Anthony Garcia, Lexa Greenley, Melissa Smith (laying down in front), Danielle Fitzpatrick (laying down in back), Avery Knoll, Yvonne Williams, Carly Cogan (seated), Emily Guinan (author), Jorge Leidi (in back), and Min Rayamajhi.*

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# Invasive Ferns and Their Rare Native Lookalikes

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*Some of the reintroduced rare ferns cultivated by Fairchild. (Left) is threatened T. heracleifolia and (Right) is endangered C. sloanei (photo credit: Elena Suarez, Broward County).*

Following the success of the invasive removal, we chose to augment the existing populations of rare ferns, helping them recolonize these newly cleared areas. To date, Fairchild has reintroduced over 250 rare ferns into these areas with help from Broward County Staff, and USDA IPRL and UF/IFAS Master Gardeners volunteers. These plants were cultivated by Fairchild, using spore material we previously collected from Fern Forest. Initial watering and caging to prevent herbivory have resulted in a high rate of survival for these reintroduced ferns, and we continue to monitor their health and organize small workdays to keep the invasive ferns at bay. The success of this project is due in no small part to the interagency collaboration and help from volunteers, and we look forward to organizing similar collaborations in the future!

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# It Takes a Village: Public Engagement and Targeted Outreach in the Florida Keys

*By: Paul Evans, Melissa Miller, and Frank Mazzotti, University of Florida's Croc Docs*

For the past two years, the University of Florida's Croc Docs lab and the U.S. Fish and Wildlife Service Crocodile Lake National Wildlife Refuge have collaborated to raise awareness for imperiled species throughout the Florida Keys archipelago. The mission was simple, raise awareness and offer training for the public throughout the region on imperiled native species and the threat of invasive species. Imperiled species in the Florida Keys are under considerable pressure from invasive species, habitat destruction, and climate change. Large invasive reptiles, such as Burmese pythons (*Python molurus bivittatus*), are of particular concern to native wildlife in the Keys. The goal is to increase the accurate identification and reporting of these species. An informed public will increase the capacity for Early Detection and Rapid Response (EDRR) efforts, a critical component to preventing the establishment and spread of invasive species.


*Educational tabling set up.*

Native species within island communities are often most impacted ecologically by invasions which have led to hundreds of extinctions globally. Key deer, Key Largo wood rats, St. Schaus swallowtail butterflies, American crocodiles, and various marine species were some of the imperiled species emphasized for this educational initiative. Additionally, the public was educated on prominent invasive species in the region including Argentine black and white tegus, Burmese pythons, common boa constrictors, Lionfish, feral cats, and various invertebrates.

Over the two-year initiative, over 1400 individuals attended outreach efforts throughout the Upper, Middle, and Lower Keys. In total, 21 events took place and ranged from educational seminars, community festivals, and training workshops. A combination

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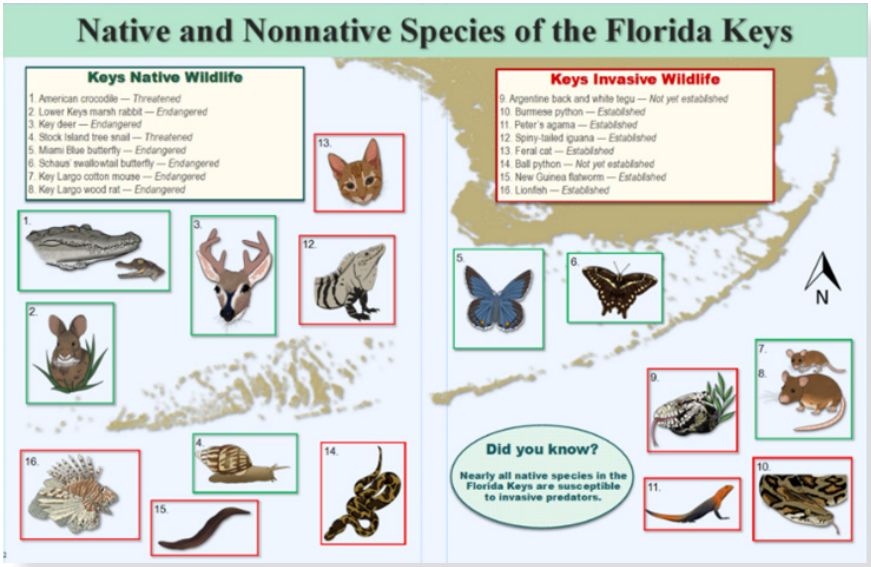
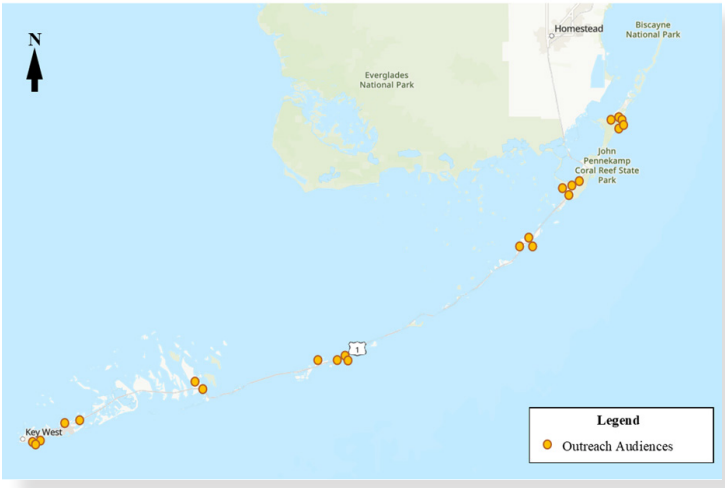
# It Takes a Village: Public Engagement and Targeted Outreach in the Florida Keys (CONTINUED FROM PAGE 7)

of in-person communications, pre-recorded educational training videos, social media posts, educational factsheets, and even a ZOOM presentation from the side of a highway were all utilized to accomplish our goal. A primary part of the educational training was to raise awareness of invasive species and encourage the use of EDDMapS IVEGOT1 service to increase public reporting in the region. Public reports in the region did increase from the 2021 reporting year through the 2023 period by nearly 180%. In total, 382 public reports occurred during this project and encompassed all major species and taxa used in the educational materials. Large public events, such as the Indian Key Celebration, typically lead to increased public reporting following the event. Hopefully, continued targeted outreach efforts will generate comparable results in reporting for the future.

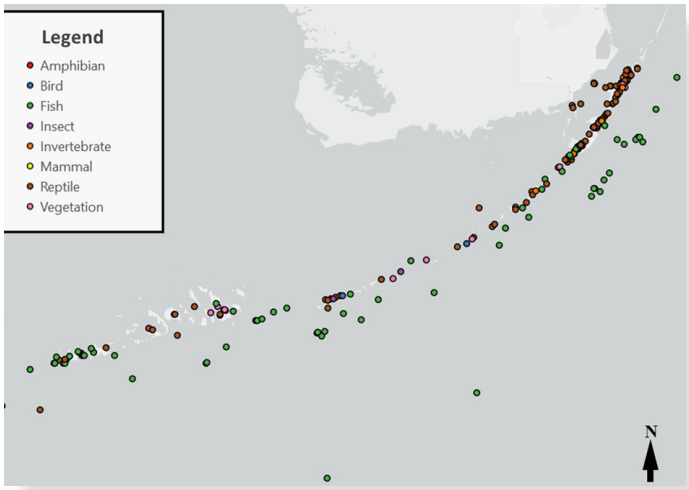



*A section of the fact sheet, 'The Unnatural History of Invasive Species in the Florida Keys: A Paradise Threatened but Not Lost'.*


*A local coral researcher attending a nonnative constrictor training put on by the Florida Fish and Wildlife Conservation Commission as a part of this project.*




*Map of locations where educational seminars and community-based events have been held, or are planned, in the Florida Keys. In total, 21 outreach events have taken place and are represented on this map.*




*Map of locations where public reports of nonnative and invasive species were reported to IveGot1. Public reports, from January 2022 through June 2023, are represented on this map, a total of 382 records.*

# Playing Detective for Invasive Tegus in Everglades National Park

*By: Amanda M. Kissel, U.S. Geological Survey, Fort Collins Science Center*

What does invasive species research in Everglades National Park (ENP) have in common with your favorite 'True Crime' podcast? Both are utilizing new technology to swiftly track down individuals of interest.

We are now at the point where once sci-fi-sounding tools are becoming reality. It is hard to go through the day without hearing or reading some reference to Artificial Intelligence (AI). For instance, how facial recognition software is being developed for use by law enforcement or on the dark web to create 'deep fakes'. Furthermore, the ever-expanding possibilities of finding and extracting DNA to pin a person to a crime scene. These recent advances in AI and DNA analysis are also promising tools for tracking and managing invasive species in the Everglades.

The USGS Fort Collins Science Center (USGS FORT) is testing the use of both technologies as tools for Early Detection and Rapid Response (EDRR) for invasive tegu lizards in currently unoccupied parts of ENP. The goal is to assist ENP managers with limited resources to deploy rapid sampling tools to gather near real-time information on where tegus might be going undetected.

By coupling cellular trail cameras that can emit pictures in real-time back to researchers with cutting-edge AI image detection algorithms, we can reduce the need for extensive visual surveys in hard-to-reach areas of the park. Throughout 2023, USGS FORT experimented with deploying cellular trail cameras in two regions of ENP (one known to have tegus and one without) and developing a 'data pipeline' for real-time analysis that can identify tegus in photos.

*Cellular trail camera setup with solar panel.*

While we prototyped the cellular trail cameras, we also worked in partnership with the developers of Microsoft's Megadetector (an image detection algorithm designed to meet the needs of wildlife managers) to improve the algorithm's ability to accurately detect tegus, leveraging almost two million photos that USGS FORT and NPS had collected in previous years doing tegu surveillance.

*Example of Megadetector output. The algorithm puts a box around the target and assigns it a probability that it is a tegu.*

Putting the real-time automated pipeline together, from cellular camera deployment to image detection to alerting park managers, is still a work in progress. We hope that this will serve as a tool to help monitor areas of ENP for the arrival of tegus and guide ENP managers as to where to focus trapping efforts.

We are testing uses of environmental DNA (eDNA) for a similar purpose. The concept of eDNA stems from our knowledge that pieces of DNA from organisms can remain in the environment to be detected. Thus, testing certain environments for the DNA of multiple organisms can be a way to quickly understand what species are present without seeing them.

Until recently, eDNA analyses had primarily been done in aquatic environments, because it is much easier to filter a water sample to extract the DNA from it. However, recent advances have expanded the opportunities for extracting DNA from terrestrial substrates such as vegetation, soil, and even the air.

USGS FORT is working to understand whether tegus 'shed' enough DNA in the environment to be picked up by our sampling strategies and to develop a targeted assay (a unique sequence of DNA) for tegus to test collected samples against. We are experimenting with different methods to 'pick up' tegu DNA from vegetation using common household items such as a paint roller or a paper towel. Both have been used successfully to collect reptile eDNA, including brown tree snakes (the paper towel method) and little brown skinks (the paint roller method).

Should efforts to develop an assay and an efficient way to sample tegu eDNA from the environment succeed, this would be yet another EDRR tool to deploy in ENP in unknown or suspected areas of tegu invasion.

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# Playing Detective for Invasive Tegus in Everglades National Park

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Sampling for eDNA would require even less equipment and time than deploying cellular cameras, making it an ideal tool for monitoring the vast wilderness area of ENP.

*USGS/University of Florida intern Gabby Silva uses a paper towel to sample for tegu eDNA.*

Our research into AI and eDNA to aid in delimiting the tegu invasion front in ENP is ongoing, and we are carefully evaluating the tradeoffs for both tools. However, we are excited by the potential to fill a much-needed monitoring gap and allow our partners to strategically focus trapping efforts.

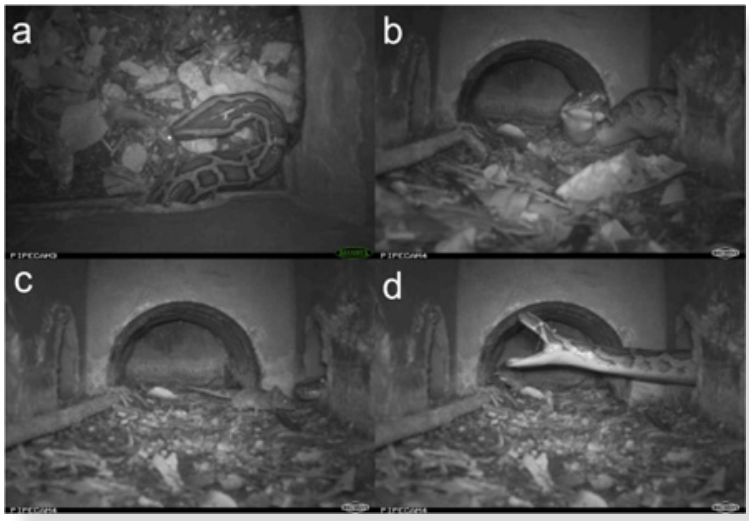
*Dr. Amy Yackel Adams (USGS Fort Collins Science Center) uses a paint roller to sample for tegu eDNA.*

# Burmese Python Seen on Camera Consuming an Endangered Species for the First Time

*By: Isaac Lord[1] and Jacquelyn C. Guzy[2]*

*[1]Cherokee Nation Technologies, Contracted to the U.S. Geological Survey, Wetland and Aquatic Research Center*
*[2]U.S. Geological Survey, Wetland and Aquatic Research Center*

During the winter of 2022, a Burmese python (*Python molurus bivittatus*) at Crocodile Lake National Wildlife Refuge in Key Largo was observed consuming federally endangered Key Largo cotton mice (*Peromyscus gossypinus allapaticola*, KLCM; Lord et al. 2023). The female python (245 cm snout-to-vent length) was part of the U.S. Geological Survey's scout snake python program in partnership with the U.S. Fish and Wildlife Service. On multiple occasions during her time within the refuge, she spent several days in an underground complex of pipes in Key Largo, but her behavior within the network was unknown. To learn more, several remote game cameras were positioned in the pipe network to observe her activities (programmed to record at a rate of 1 photo/minute and triggered by motion).




*(A) Burmese python pointing snout at recently subdued KLCM. (B) Python swallowing KLCM. (C) KLCM approaching snout of python. (D) Python unsuccessfully striking at KLCM.*

On November 28, 2022, at 01:14, the python was documented consuming a KLCM and on December 1, 2022, at 01:31 she was seen eating a second. Between her entrance into the network on October 26 and her exit on December 5, we witnessed 5 strikes at KLCM, two of which led to feeding events that represented a predator-prey mass ratio of less than 1 % (i.e., the mouse was less than 1 % of the python's body weight). Thus far, feeding upon such small prey has been

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# Burmese Python Seen on Camera Consuming an Endangered Species for the First Time (CONTINUED FROM PAGE 10)

expected to be energetically inefficient for a python of this size.

North Key Largo represents the global home range of the KLCM and the federally endangered Key Largo woodrat (*Neotoma floridana smalli*, KLWR). The latter has low fecundity (i.e., few offspring) for a rodent and is already threatened by rising tides, habitat destruction, and feral cats. Diet analysis on pythons captured from Key Largo reveals that KLCM and KLWR are both predated upon, particularly KLWR, which were found in the stomach contents of 25 % of the pythons surveyed, and KLCM was found in 11 %. This situation likely represents an optimal hunting scenario for a Burmese python. The snake situated herself at the confluence of seven subterranean pipes, and a vertical cement "chimney." Python feeding frequency and the success rate of feeding attempts remain unknown in their invasive range, however, observations like these provide useful insights into feeding ecology and may prompt future studies.

*Literature cited:*

*Lord I, Redinger J, Dixon J, Hart KM, Guzy JC, Romagosa CM, and Cove MV. 2023. Telescoping prey selection in invasive Burmese pythons spells trouble for endangered rodents. Food Webs, 37, p.e00307*

# See a Snake, Save a Snake: Use of External Tags to Prevent Mortality in Pythons Used in Research

*By: Gretchen Anderson[1], Lisa McBride[1], Mark Sandfoss[1],and Amy Yackel Adams[2]*

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*[2]U.S. Geological Survey, Fort Collins Science Center, Fort Collins*

Scout Snakes, radio-tagged snakes re-released into the wild, are an important tool used by researchers in South Florida. They allow us to learn about the life history of invasive Burmese pythons, and during the breeding season, they lead us to other pythons that we can then remove from the environment. While Scouts are a very useful tool, they are also a very expensive one. The cost of transmitters, tracking equipment, surgeries, and tracking, makes these snakes expensive. Finding and recruiting good snakes for the team is also a challenge and it can take months to find one good candidate. Each Scout represents an investment of thousands of dollars, and with contractors pulling out record numbers of snakes each year, we needed a way to distinguish our undercover agents from other pythons.

*FLOY© tag attached to the lefthand side of a salmon's dorsal fin (photo credit: Des Colhoun).*

*A Scout python with a FLOY© tag attached to its neck (photo credit: Austin Fitzgerald).*

For the past several years, the USGS Fort Collins Science Center has been trialing various external marking methods on our Scouts. Borrowing a trick from fish scientists, we started using FLOY© tags to externally mark our snakes. These large tags are easy to apply and long-lasting, even in the tough Everglades environment. Usually, they last a year or longer and even if they do fall out, a new tag can be applied in the field in minutes. It also helps that they are bright orange!

*Scout snake with FLOY© tag submitted by contractor (photo credit: Reed Gearhart).*

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# See a Snake, Save a Snake: Use of External Tags to Prevent Mortality in Pythons Used in Research (CONTINUED FROM PAGE 11)

So far, these tags seem to be working! Contractors have reported capturing our Scouts, recognizing the external tag, and then releasing them three times this past year (2023). One snake was even captured and released twice, thanks to his tags. When a contractor catches a Scout with a tag, they send an email to bicy_python@nps.gov with the snake's ID number, the location, and some photos. The contractor still gets paid for the capture and our Scout gets released to continue its important work helping us better manage this cryptic species. We also encourage members of the public who see any snakes with these tags to report them and their locations!

*Scout snake with FLOY© tag submitted by contractor (photo credit: Amy Siewe).*

# Spatial Invasive Infestation and Priority Analysis (SIPPA)

*By: Deb Stone, University of Florida, School of Forest, Fisheries and Geomatics Sciences*

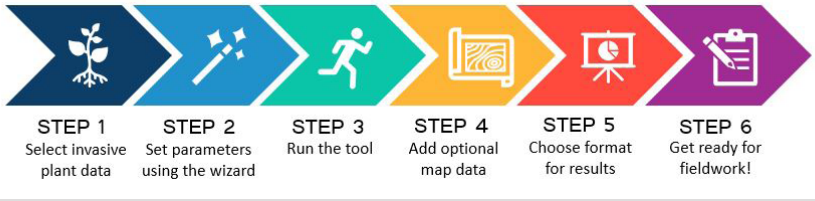
We never have enough resources to address all our problems, particularly for invasive species management. Strategic prioritization is crucial to effectively address both increasing invasions and uncertainty from climate change. While it may be time-consuming, it's also necessary for adaptive management and optimizing limited resources. Even if we don't realize it, we are constantly prioritizing due to these same resource constraints-meaning ad hoc decisions can be our standard operating procedure.

A systematic approach offers many advantages, including better natural resource protection, enhanced transparency and repeatability, more efficient resource use, and improved institutional memory. Incorporating a spatial dimension further enhances these benefits. It allows us to differentiate between populations of the same species based on their location, size, etc. Visualizing data on maps is more engaging and informative than tables, improving both workday logistics for staff and communication with stakeholders.

Thinking of the bigger picture, when we pool our spatial data using sites like EDDMapS, it allows us to take a multi-scale approach to our invasive management. This is critical to success-invasive species know no boundaries, so we must work together to address them at a large scale. But at the same time, most of us also have to work primarily within a smaller space limited by some sort of property boundary.

We have a free, online tool, that can help with that. The Spatial Invasive Infestation and Priority Analysis, or SIIPA for short, analyzes your invasive plant data and determines which areas should be treated first based on your personalized preferences. It brings the power of big data and spatial analysis together to an easy-to-use website to make this technology available to a wider group of users.

The SIIPA tool is designed for land managers who want help prioritizing their resources. This framework prioritizes invasive populations based on: 1) the impacts of the species; 2) the extent of the infestations; 3) available control methods; and 4) habitat quality.



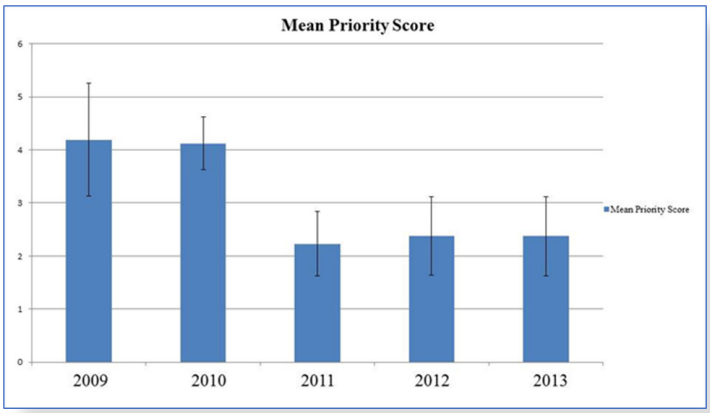

Simply set your custom parameters using the wizard and run the tool. SIIPA will create a ranked list of which areas/ plant populations should be treated first to have the greatest positive impact.

My experience at The Nature Conservancy's Disney Wilderness Preserve showcases how the SIIPA tool can improve invasive management. We started a new database in 2009 and implemented SIIPA in 2011-2013, so we had what is essentially two years of

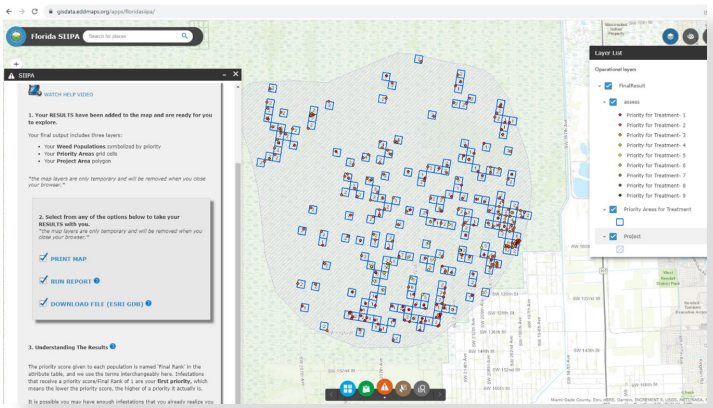
CONTINUED ON PAGE 13

# Spatial Invasive Infestation and Priority Analysis (SIPPA)

**(CONTINUED FROM PAGE 12)**




*Mean Priority Scores of invasive plant treatments at The Nature Conservancy's Disney Wilderness Preserve before using SIIPA (2009 and 2010), compared to with using SIIPA (2011 – 2013). In SIIPA, the highest priority is a score of 1 and the lowest priority is a score of 9.*




*Example SIIPA output for a parcel within the Everglades CISMA. The output options can be seen on the left, a map of the final output in the middle, and a legend on the right.*

'control' data and three years of 'treatment' data. In SIIPA, the highest priority is a score of one and the lowest priority is a score of nine. While most of my treatment decisions before SIIPA were good decisions, not every treatment decision was- my average priority score was four, or medium priority. Once I started using SIIPA, my average priority score was two, or high priority. The SIIPA tool improved my treatment decision-making and helped us make better use of our limited resources.

Find more information at: https://www.eddmaps.org/florida/SIIPA/#home. If you are interested in training on the SIIPA tool or have any questions, please contact Deb Stone at debitharp@ufl.edu.

# What Else Is Eating the Invasive Burmese Python?

*By: Jose Alberto Torres and Jacquelyn Guzy, U.S. Geological Survey, Wetland and Aquatic Research Center*

Invasive Burmese pythons (*Python molurus bivittatus*) are responsible for drastic alterations to native food webs throughout southern Florida. However, on the 2nd of September 2022, we witnessed a unique observation of a native species gaining the upper hand. Working closely with the National Park Service (NPS) in Big Cypress National Preserve, teams from the U.S. Geological Survey (Wetland and Aquatic Research Center and Fort Collins Science Center) enabled by invaluable partnerships with the University of Florida and Zoo Miami, use radiotelemetry to track pythons across the landscape. The goal of this research is to collect data to inform the management of this species.

As we tracked a radio-telemetered hatchling python in the vicinity of Loop Road, just eight days after the release of the python, we were led to a Florida kingsnake (*Lampropeltis floridana*) that had consumed the python. The kingsnake had a snout-vent length (SVL) of ~89 cm long and the hatchling python was ~64 cm SVL, weighing in at ~100 g. Upon capture the kingsnake was found to weigh ~210 g. We subsequently tracked the kingsnake daily until recovering the python's transmitter in the kingsnake's feces 14 days later, approximately 122 m northwest of the initial discovery. Florida kingsnakes are dietary generalists and consume snakes, as well as lizards, amphibians, birds, mammals, and eggs of turtles and birds.

Notably, other predators have been found to consume pythons, including the American alligator (*Alligator mississippiensis*), Gulf Coast indigo snake (*Drymarchon kolpobasileus*), American crocodile (*Crocodylus acutus*), Bobcat (*Lynx rufus*), and the Florida cottonmouth (*Agkistrodon conanti*). Now, we can add another native species to the list. This observation has been

**CONTINUED ON PAGE 14**

# What Else Is Eating the Invasive Burmese Python? (CONTINUED FROM PAGE 13)


*(A) First record of a Florida kingsnake consuming a hatchling Burmese python in Big Cypress National Preserve, Florida, USA. (B) Close view showing the food bolus at midbody (arrow) caused by the python.*

described in more detail in a recent publication by Crawford et al. (2023).

While our observation indicates that hatchling pythons are vulnerable to kingsnake predation, pythons have also altered host-parasite dynamics by introducing a non-native lung parasite to native Florida snakes, including kingsnakes (e.g., Miller et al. 2020). Future research documenting the prevalence of pythons in kingsnake diets may be useful for understanding disease transmission and population impacts.

*Literature cited:*

*Crawford PF, Torres JA, Guzy JC, Currylow AF, McBride LM, Anderson GE, McCollister MF, Romagosa CM, Adams, AAY and Hart KM. 2023. Florida Kingsnake (Lampropeltis floridana) consumes a juvenile Burmese Python (Python molurus bivitattus) in southern Florida. Reptiles & Amphibians, 30(1), pp. e19971-e19971.*

*Miller MA, Kinsella JM, Snow RW, Falk BG, Reed RN, Goetz SM, Mazzotti FJ, Guyer C and Romagosa CM. 2020. Highly competent native snake hosts extend the range of an introduced parasite beyond its invasive Burmese python host. Ecosphere, 11(6), p.e03153.*

CISMA
Everglades Cooperative Invasive Species Management Area

ECISMA was created to formalize cooperation among land management agencies to improve the effectiveness of exotic species control by sharing information, innovation and technology across borders through a memorandum of understanding with the ultimate goal of helping to ensure the success of the Comprehensive Everglades Restoration Plan.

www.evergladescisma.org

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## Agency/Organizations Abbreviations

ECISMA- Everglades Cooperative Invasive Species Management Area
EDDMapS- Early Detection & Distribution Mapping System
EDRR- Early Detection & Rapid Reponse
EPAP- Exotic Pet Amnesty Program
FOE- Friends of Everglades CISMA, Inc.
FDACS- Florida Deparment of Agriculture & Consumer Services
FWC- Florida Fish & Wildlife Conservation Commission
NPS- National Park Service
SFWMD- South Florida Water Management District
UF- University of Florida
USDA- U.S. Department of Agriculture
USGS- U.S. Geological Survey

## 2023 ECISMA Newsletter

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