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# Research in the Everglades - USGS Invasive Species Program

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U.S. Department of the Interior
U.S. Geological Survey

# USGS Invasive Species Research in the Everglades

- Funded through Ecosystems Mission Area
- Two programs:
  - Environments – Priority Ecosystems
  - Invasive Species (INV)
- About 1.94M in FY 2015

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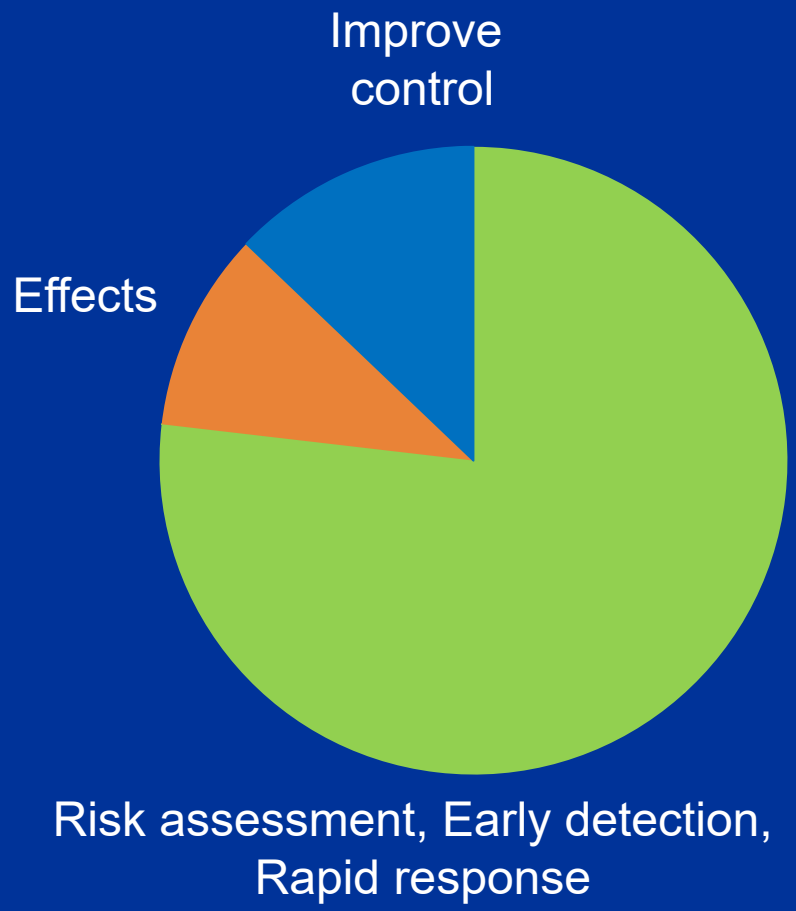
# INV Program Everglades Research - 2015

13 research projects

Totaling 1.2M in 2015

6 Burmese pythons
4 Argentine tegus
2 Fish
1 Coordination
1 Plants

Fort Collins Science Center
Southeast Science Center

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# Risk Assessment, Early Detection, Rapid Response

Burmese Pythons

- Radio telemetry in SW Florida
- ID of dispersion vectors across using GPS tracking
- Northern range & detection probability using eDNA
- Testing HSI for mgt & restoration planning

Argentine Black and White Tegu

- Feasibility study for occupancy project in FL
- Evaluating spatial mapping & analysis techniques to monitor & forecast spread of newly-invasive species
- Integrating science & management for optimal prevention & control of Argentine tegu (and melaluca)

Freshwater Fish

- Everglades Freshwater Fish Invaders
- Regional coordination & EDRR of non-native fishes

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# Radiotelemetry of Burmese pythons in SW FL –

## Bartoszek, Andreadis and Reed

### Burrow use by tagged pythons

| Subject | Total L (m) | Mass (kg) | Proportion in burrow | # diff. burrows |
|---|---|---|---|---|
| F01 | 2.31 | 7.1 | 0.03 | 1 |
| F02 | 3.05 | 22.7 | 0.51 | 10 |
| F03 | 3.66 | 32.7 | 0.36 | 2 |
| F04 | 3.41 | 25.9 | 0.06 | 1 |
| F05 | 4.45 | 45.4 | 0.00 | 0 |
| F06 | 4.27 | 47.2 | 0.41 | 4 |
| F07 | 3.05 | 20.0 | 0.39 | 1 |
| | | | | |
| M01 | 3.38 | 21.8 | 0.46 | 10 |
| M02 | 3.96 | 37.5 | 0.24 | 9 |
| M03 | 3.15 | 16.7 | 0.05 | 1 |
| M04 | 3.20 | 15.0 | 0.00 | 0 |
| | | | | |
| mean | 3.44 | 26.5 | 0.23 | 3.5 |

### Burmese Python nest locations*

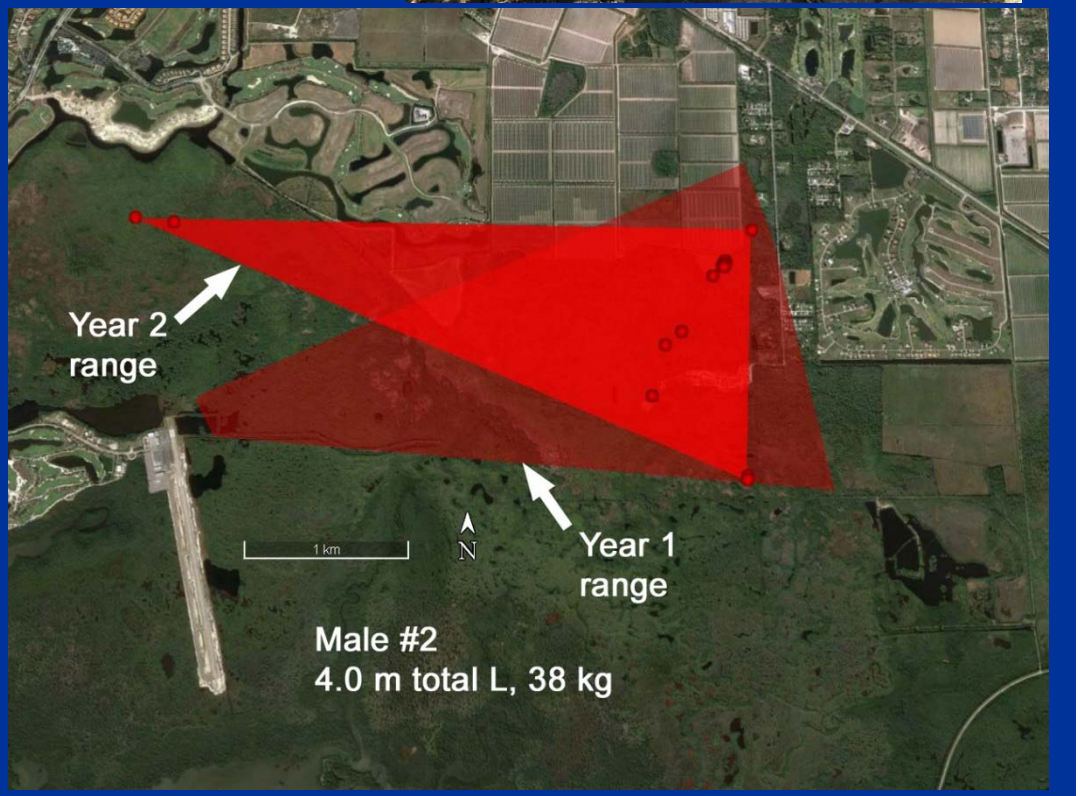
Anthropogenic underground : 2

Mammal burrow : 6

Reptile burrow : 1

Surface/grass : 3

* 3 serendipitous finds plus 9 clutches from 8 radiotagged females



# Identification of dispersion vectors across the landscape using GPS tracking - Hart

This 1-year telemetry study will track simultaneously in 3 locations (Everglades, Rookery Bay, and near Loxahatchee NWR). Determining movement rates and habitat-use patterns of pythons across landscape

GPS tags provide many locations/individual/day and night, and is a new tool ready for field deployments after successful pilot testing in 2013 and 2014

A modeling component will use a combination of IBM and field research to estimate effects of movement behavior and navigational abilities on rate of spread and invasion routes

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# Integrating science & management for optimal prevention & control of aquatic invasive species in the Everglades –

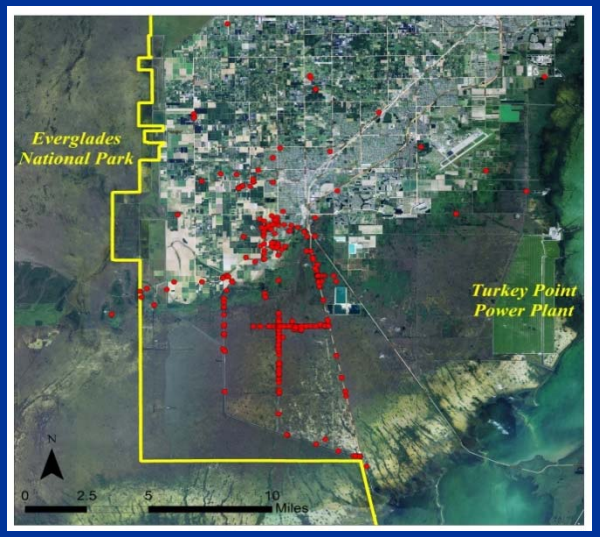
**Johnson, Martin, and Romagosa**

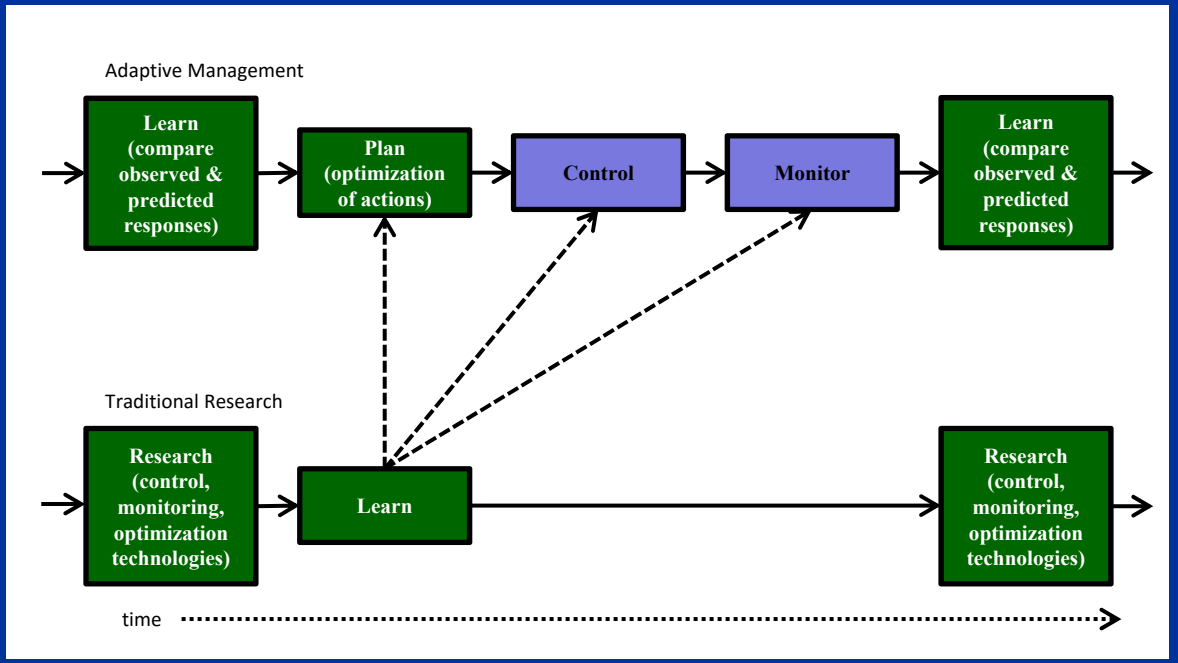
Structured Decision Making approach:

(1) Argentine tegu – population growth potential and control strategies

(2) Melaluca – model dynamics, effects and responses to treatment

(3) Species screening tool for Everglades

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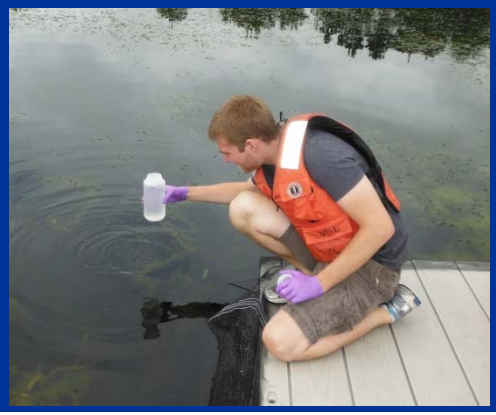
# Using environmental DNA for Burmese python detection probabilities and range-delimitation in southern Florida - Hunter

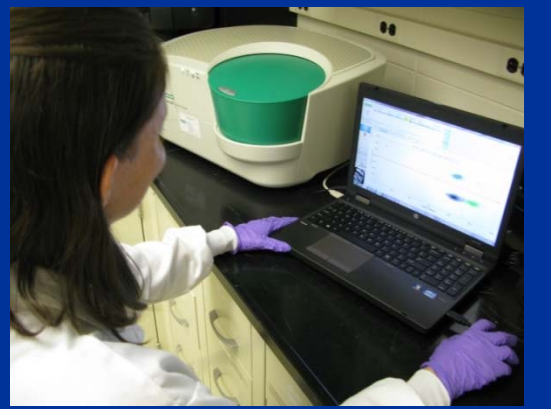
Need better estimates of detection & occurrence to better characterize inhabited vs. newly colonized areas

To assess estimates, 26 locations with 5 replicates each were densely sampled in ENP, an area with a large resident population

Samples and detection estimates are being analyzed using newly customized Bayesian occupancy models

Water samples were also collected outside known range to better define population range limits





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# Regional Coordination and EDRR of Non-native Fishes in the Everglades - Schofield

Planned 2 field days at Everglades Invasive Species Summit

Fall 2015: Broward County for range expansion of bullseye snakehead and Jack Dempsey cichlid

Also planned a Fish Chat, a one-day conference wherein scientists and managers working on non-native fishes in FL present current research

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# Effects of Invasive Species in the Everglades

Burmese Pythons

- Diet study

Freshwater Fish

- Effects of African jewelfish


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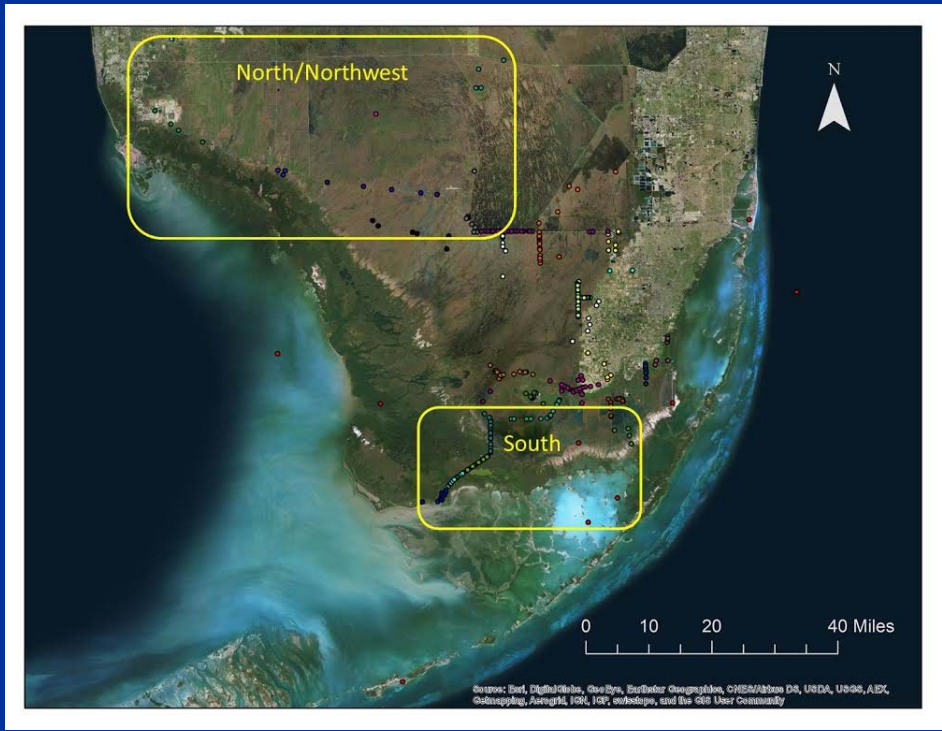
# Burmese Python Diet Study – Reed and Romagosa

Gut contents from 652 pythons (2009-15) by location and then year

Examined 52 samples; identified 42 samples to taxa: 33 mammals, 26 birds, and 3 alligators

***Very*** preliminary data suggest possible spatial and temporal shift in prey species:

- South: diet may be shifting from primarily mammals (75% and 25% birds) to more birds (56% and 37% mammals); only recovered Hispid cotton rat
- North: diet may have remained primarily mammals (70% and 30% birds); 6 mammals

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# Effects of African jewelfish on Everglades - Schofield

Previous mesocosm study demonstrated strong effect of African jewelfish on a simulated Everglades ecosystem while a native predator (dollar sunfish) did not

In a follow-up study that will span FY 15 and 16, examining combined effects of jewelfish and sunfish and assess competition between the predators

In FY 15 completed project planning and experimental design, renovation of lab space and conducted a pilot study. The full 8-month experiment will be run in FY 16.

African jewelfish
(*Hemichromis letourneuxi* )

Dollar sunfish (*Lepomis marginatus*)
Photo by Howard Jelks, U.S.G.S.

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# Improving Control of Invasive Species in the Everglades

Argentine Black and White Tegus

- Thermal biology and behavior of brumating tegu

Freshwater Fish

- Development of novel control techniques for non-native fishes in the Everglades

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# Thermal biology and behavior of brumating black and white tegus – Collier and Reed

- Determining when & where black and white tegus brumate by radio-tracking 35 adult tegus over 2015/16 inactive season
- Describing thermal refuge characteristics; using automated cameras observe behavior during brumation
- Characterizing thermal biology of brumation using implanted and autonomous temperature loggers


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# Development of novel control techniques for non-native fishes in the Everglades – Schofield/Hunter

**Parental removal**

Can we exploit this trait: Does removal of one or both parents lead to loss of brood?

Began series of pilot studies on Mayan cichlid to develop and refine experimental design and technique

**Bullseye snakehead eDNA**

Prepared probe to sample water for eDNA and field-validated selectivity and effectiveness

Will use occupancy modelling to determine sampling regime

In FY 16 we will use the probe to better delineate current range and monitor natural areas for encroachment

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