1. Abstract of the Program
   The Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP) is a citizen science wildlife monitoring and educational outreach program offered by the UF/IFAS St Lucie County Extension. Supporting partners include the St Lucie County Environmental Resources Department, UF/IFAS Ft Lauderdale Research and Education Center and the UF/IFAS Florida Master Naturalists of St Lucie County. The UF/IFAS St Lucie County Natural Resources Extension Agent serves as program facilitator. This program addresses the invasive reptile problem in St Lucie County, FL through original research and extension of UF/IFAS research-based information. The program involves volunteer training on invasive nonnative reptile identification and biology, wildlife monitoring research, public outreach on the biology and management of nonnative invasive reptiles, and professional conference presentations and published proceedings.

2. The Problem/Need of the Program
   The UF/IFAS St Lucie County Extension began the Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP) citizen science program on March 12, 2013 to address the area’s growing invasive reptile problem. The UF/IFAS St Lucie County Extension is a department of the St Lucie County Board of County Commissioners. Supporting partners for this program include the St Lucie County Environmental Resources Department, UF/IFAS Ft Lauderdale Research and Education Center and the UF/IFAS Florida Master Naturalists of St Lucie County. Nonnative invasive reptiles are a challenging environmental issue in St Lucie County, FL. The presence of large nonnative constrictors such as Burmese pythons are an example of the invasive reptile problem in South Florida that has gained international attention through news media reports. The EIRAMP includes volunteer training, resource monitoring, public outreach and professional conference presentations and published proceedings.

   The most common invasion pathway for these reptiles to arrive in Florida occurred through the pet trade (Krysko et al, 2011). Some species arrived through other pathways. For example, curlytail lizards (Leiocephalus carinatus armouri) were released intentionally in the 1940s in Palm Beach in an attempt to rid sugarcane of insect pests, and its population has since expanded both north and south (Weigl et al. 1969). Information retrieved on May 23, 2016 from the Eddmaps invasive species reporting website lists 152 exotic reptile species and 16 exotic amphibian species in Florida.

Figure 1. Curlytail lizard in South Florida. (Photo Credits: G. Bott)
Under the direction of the UF/IFAS Natural Resources Extension Agent, Florida Master Naturalist Ellen Butler conducted an invasive reptile awareness and perception survey in St Lucie County and adjacent Martin County for one relatively new invasive reptile: *Agama agama*. This reptile is common and is known as the rainbow lizard because males have a characteristic red head, indigo body and red striped tail. She conducted intercept surveys of 40 people in public areas. 60% of the respondents were from St Lucie County while 28% were from adjacent Martin County.

![Male Agama agama](image1.png)

*Fig. 2 Male Agama agama*

*Photo Credits: Pam Harting, Florida Master Naturalist*

![Female Agama agama](image2.png)

*Fig 3. Female Agama agama*

*Photo Credits: Pam Harting, Florida Master Naturalist*
The following determinations were made:

- 87.5% (35/40) have heard the term or concept “invasive species"
- 90% (36/40) believe invasive species are a problem in Florida
- 70% (28/40) indicated they have not seen or heard of Agama agama
- Once shown a picture, 67.5% (27/40) respondents said they had seen one.
- When asked if they believe Agama agama is a problem in Florida:
  - 60% “Don’t Know”
  - 32.5% “Yes”
  - 7.5% “No”

Ms. Butler also surveyed respondents’ emotional responses ranking them by positive, negative or neutral feelings (n=70).

<table>
<thead>
<tr>
<th>Positive (21%)</th>
<th>Negative (39%)</th>
<th>Neutral (40%)</th>
</tr>
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<tbody>
<tr>
<td>Amazed (5)</td>
<td>Annoyed (12)</td>
<td>Curious (20)</td>
</tr>
<tr>
<td>Happy (5)</td>
<td>Anxious (4)</td>
<td>Surprised (8)</td>
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<tr>
<td>Delighted (4)</td>
<td>Disgusted (4)</td>
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<tr>
<td>It’s Cool (1)</td>
<td>Fearful (3)</td>
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<tr>
<td></td>
<td>Startled (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frustrated (1)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Emotional Responses to Agama agama

In addition, the Invasive Reptile Extension Needs Assessment was created by the UF/IFAS Natural Resources Extension Agent in St Lucie County and was disseminated on May 23, 2016 to 101 Florida Master Naturalists in St Lucie and neighboring counties. 55% of these survey recipients agreed to the informed consent and participated in the needs assessment. This needs assessment survey was designed to do the following: (a) analyze end users’ perceived knowledge of invasive reptiles and their management, (b) analyze end users’ preferred methods of obtaining information on invasive reptiles and their management, (c) determine the characteristics, needs and priorities of the target audience, and (d) determine types and numbers of educational resources currently being used by end users.
Survey respondents were asked where invasive reptiles were most likely to be seen in St Lucie County. 53 people responded. 49% (26/53) of the respondents indicated “they’re everywhere” while 21% (11/55) indicated seeing them in “urbanized areas.” Only one respondent indicated “I never see them.”

When asked where they prefer to get their invasive reptile management information, the majority of respondents indicated the UF/IFAS Extension Office while conversely word of mouth and local news were the least preferred ways for them to obtain invasive reptile management information.

Finally, Florida Master Naturalists in St Lucie County were asked about their level of comfort with the increased number of invasive reptiles being found in Florida and their management. An overwhelming majority of 91% (49/54) indicated a level of concern and discomfort with the increased numbers of invasive reptiles being found in Florida. They also overwhelmingly indicated that they were comfortable with the use of humane, lethal methods of controlling invasive reptile problems in Florida.

3. Description of the Program
Volunteer training, resource monitoring, public outreach, and professional conference presentations and published proceedings are the major components of the Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP) offered by the UF/IFAS St Lucie County Extension.

Volunteer Training - Volunteer training is the first initiative of the Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP). The UF/IFAS Florida Master Naturalists are the primary group of volunteers trained by – and assisting - the UF/IFAS St Lucie County Extension with community outreach and resource monitoring. As an addendum to the required 120 hours of formal coursework to become a certified Florida Master Naturalist, the instructional team in St Lucie County has incorporated new information about invasive reptile biology and management into the coursework. The instructional team also provided Florida Master Naturalist trainees with a range of learning options resulting in increased awareness and experience richness with the invasive reptile issue. In addition, continuing education opportunities are made available for program graduates. For example, program graduates were invited to learn to use aural and visual senses to identify and report invasive reptiles in the field.

Resource Monitoring - The second initiative of the Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP) is resource monitoring. Graduates of the Florida Master Naturalist Program in St Lucie County were invited to participate in the EIRAMP resource monitoring. Two Florida Master Naturalist lead instructors in St Lucie County, along with five program graduates, comprise the core resource monitoring team. The UF Croc Docs were engaged in the program to provide training and equipment to this team. The UF Croc Docs are a team of UF/IFAS
specialists conducting research on pythons and other invasive reptiles in the Florida Everglades. Equipment included GPS units and Kestrel handheld weather monitoring devices that record wind speed and humidity. The EIRAMP team utilizes aural and visual techniques to survey for native animals as well as invasive reptiles. The goal of this team is to conduct wildlife monitoring on survey transects adjacent to freshwater systems where they monitor and record nonnative invasive wildlife as well as make a baseline determination of native wildlife currently in the area. A transect is a sample area in the form of a long continuous strip. The information they record is uploaded to the UF Croc Docs and will be used to monitor the spread and impacts of invasive species throughout the region.

![Figure 4. Master Naturalists Cindy Christie (left) and Mary Calo learning to use a Kestrel wind speed meter (Photo Credits: K. Gioeli)](image)

**Public Outreach** - Public outreach is the third initiative of the Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP). A multifaceted approach to public outreach for the EIRAMP includes teaching short courses and presentations for the general public as well as professional audiences. Social media is also utilized. The UF/IFAS St Lucie County Natural Resources Extension Agent working with Florida Master Naturalist volunteers comprise the core EIRAMP instructional team. Targeted audiences have varied from the general public in St Lucie County to Florida Power and Light (FPL) field crews and the City of Port St Lucie Utilities Department. The goal is to increase understanding of the biology and management of invasive reptiles and how to properly report them when seen in the field.

Effectiveness of educational outreach efforts have been evaluated using pre and post survey methods to measure knowledge gain and practice changes that resulted from program participation.
Professional Conference Presentations and Proceedings – The Natural Resource Extension Agent conducted presentations at local, state and national professional conferences. These presentations are designed to teach other researchers and extension faculty about the invasive reptile management extension program.

4. Responding to Economic Downturn
In 2009, St. Lucie County Administration had to address a $51 million budget shortfall. This shortfall was the result of falling property values and the corresponding reduction in tax revenue. County Administration had the task of maintaining essential services. St Lucie County’s Extension Agents had to be innovative and cost-effective in their efforts to implement and evaluate the Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP). This Extension Program was operated successfully at no cost to the county. A team of Florida Master Naturalists volunteered 219 hours, valued at $4,753.41, to the EIRAMP. In 2014, 97.74 hours were donated to the program valued at $2,076.21; in 2015, 25 hours were donated valued at $552.00; in 2016, 96.25 hrs were donated valued at $2,125.20. GPS units, Kestrel weather meters and other expenditures were at no cost to the St Lucie County Board of County Commissioners and were provided by the UF/IFAS Ft Lauderdale Research and Education Center.

“Calculation of economic value of trained volunteers’ contribution to extension programs: According to 2015 Florida data from the Independent Sector (http://independentsector.org/volunteer_time) the estimated dollar value of a volunteer hour is $22.08. In Extension, trained volunteers are contributing to Extension program by dedicating their time, skills, talents and expertise under supervision or guidance by faculty. The estimated dollar value of a volunteer hour in Florida was $22.08 in 2015, $21.24 in 2014, $18.85 in 2011-13, $18.66 in 2010, $17.78 in 2009, $17.56 in 2008 and $16.07 in 2007.”

5. Use of Technology

Invasive Reptile Extension Needs Assessment
The Invasive Reptile Extension Needs Assessment was designed by the UF/IFAS St Lucie County Natural Resources Extension Agent utilizing the Qualtrics survey instrument available to UF faculty. Qualtrics enabled piping of questions based on prior responses which helped target questions specific to the responder. The needs assessment was distributed to 101 Florida Master Naturalists in St Lucie and neighboring counties.

Resource Monitoring Equipment
Florida Master Naturalist volunteers used aural and visual wildlife survey techniques along two 10-mile transects. GPS devices and Kestrel weather monitoring devices were used for resource monitoring. Florida Master Naturalists identified three waypoints on the transects using GPS devices. This enabled the volunteers to go to the exact waypoint location and collect observation data that
was uploaded to the UF/IFAS Croc Docs. The measurements also included wind speed, time of day, humidity as well as data on native and invasive wildlife identified at the waypoint.

6. Cost of the Program
Program costs were minimal. A team of Florida Master Naturalists volunteered 219 hours, valued at $4,753.41, to the EIRAMP. Costs associated with this program included purchasing GPS Units (3) costing $279 and Kestrel Pocket Weather Meter (3) costing $417. These devices were made available at no cost to the St Lucie County Board of County Commissioners and were courtesy of the UF/IFAS Ft Lauderdale Research and Education Center.

7. The Results/Success of the Program
Volunteer Training - Sixty-six Florida Master Naturalists received training on invasive reptile biology and management since 2013. This training was provided by the UF/IFAS Natural Resource Extension Agent and colleagues in the St Lucie County Environmental Resources Department. Thirteen Florida Master Naturalists successfully completed the UF/IFAS Introduced Reptile Early Detection and Documentation (REDDY) training while four students completed training for Nonnative Reptile Removal – Python Removal. Ten Florida Master completed hands-on python capture and containment training.

Figure 5. Florida Master Naturalist Melissa Jansen learns how to handle invasive constrictors. (Photo Credits: Kyle Jansen)
Resource Monitoring - Two Florida Master Naturalist lead instructors and six Master Naturalists worked with the UF Croc Docs to implement resource monitoring. Participating Master Naturalists received training to use aural and visual wildlife survey techniques along two 10-mile transects. Survey datasets include native and invasive reptiles, amphibians and mammals observed at three waypoints on each transect. These datasets are uploaded to the UF Croc Docs. The objective is to continue providing long term data on native and invasive wildlife to the UF Croc Docs to measure the changes in species composition over time.

Public Outreach - Florida Master Naturalists began invasive reptile public outreach in 2013. “Eyes and Ears” training was provided by Florida Master Naturalist Jo Moore for 159 FPL employees in South Florida. Program participants learned about invasive reptile identification and biology as well as proper reporting protocols when encountering invasive reptiles. That same year, Master Naturalists distributed 372 invasive constrictor identification sheets, 258 Reptile Early Detection and Documentation Training Course flyers, and 414 ivegot1 Python Patrol posters. Florida Master Naturalists provided invasive reptile education for 533 people in 2013, 186 in 2014, 109 in 2015 and 210 in 2016 reaching a total of 1038 people.

Effectiveness of outreach efforts has been evaluated. In May 2016, the Natural Resources Extension Agent and Florida Master Naturalist Marjorie Flory provided invasive reptile identification and management presentations for seventy-five City of Port St Lucie Utilities Department employees. A self-evaluative survey using a weighted Likert scale was used to determine knowledge gain. A review of survey results indicated that the highest level of knowledge gain was in the areas of “Reporting Invasive Reptiles Using ivegot1” (213% increase) and “Ways You Can Help with the Invasive Reptile Issue” (103% increase). The area of lowest knowledge gain was “Definition of Invasive Species” (52% increase). Plans are in place to extend presentations to other agencies.

Professional Conference Presentations and Proceedings - A national and a state presentation were conducted at professional conferences in 2016 to share the results of the Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP).


Gioeli, K., Mazzotti, F., Metzger, E., and Rochford, M. The Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP) – A Florida Master Naturalist Citizen
8. **Worthiness of an Award**

The Everglades Invasive Reptile and Amphibian Monitoring Program (EIRAMP) heavily relies on highly trained Florida Master Naturalist volunteers to conduct citizen science and public outreach. Ken Gioeli, UF/IFAS Natural Resources Extension Agent, and Amanda Thompson, Natural Resources Management Coordinator with the St Lucie County Environmental Resources Department are collaborating lead instructors for the UF/IFAS Florida Master Naturalist Program in St Lucie County. Programs conducted by the Florida Master Naturalist volunteers have resulted in significant impacts and have been the recipients of three national awards since 2014.


9. **Supplemental Materials**

Literature Cited


Figure 6: Extension Agent Ken Gioeli demonstrates catch techniques on this wild-caught rock python. Photo Credits: Amanda Thompson

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