

Greening STEM Biodiversity Series



Grades 6-8

Overview

In this project, students will be responsible for researching the relationship between the invasive Cuban brown anole and the native green anole found in South Florida. Using sample data provided they will conduct background research and analysis on South Florida anoles. Then they will embark on their own survey, analyze their collected data using basic statistics and visualize it through graphs. They will compare and contrast their survey data with the sample data provided and develop an explanation as to why their data trends were similar or different. In the survey, if portable devices are available for use, they will learn how to use iNaturalist.

Lesson Objectives

- Students will be able to utilize credible resources as a tool for completing research on a specific topic.
- Students will be able to analyze data and form conclusions based on their analysis, including by using basic statistics.
- Students will be able to compare and contrast data provided with the data collected in their own wildlife survey.

Key Ideas and NGSS (Grades 6-8)

- Invasive reptiles in Florida often have no natural predators in their new home environment and displace native species. (MS-ESS3-3, MS-LS2-1)
- Biodiversity is the variety of life found in an ecosystem and higher biodiversity in an ecosystem can make it stronger and more resilient. (MS-LS2-4, MS-LS2-5)

Additional Standards: *Mathematics – 6.SP.A.3, 6.SP.B.4, 6.SP.B.5, 7.SP.A.1, 7.SP.A.2, 7.SP.B.4, ELA/ Literacy - CCRA.L.6, RST.6-8.4, WHST.6-8.2*



Green iguana (*Iguana iguana*)

Background Information

Introduction to Biodiversity

Biodiversity is the natural variations of living organisms, including plants and animals, at all levels, from genes and microorganisms, to habitats and ecosystems. It tends to be richest in the tropics, including rainforests on land and coral reefs in oceans, in part due to a warmer climate. It may be hard to see how an animal that is only found in one remote part of the world can impact you personally, but having biodiversity on earth is essential for human survival. Biodiversity on earth is the reason we have food, drinking water, oxygen to breathe, medicines, and shelter. Having diverse life means that different factors, such as increased solar radiation from the sun, or a disease, doesn't wipe out all life on earth, but rather that some life can continue to thrive.

A Major Threat to Biodiversity

Biodiversity is important because it makes an ecosystem more productive as each organism fills a specific role or function making it more resilient and able to withstand changes. The complex interactions between members of different species often keep each other in check, creating a balanced ecosystem. Removing one or multiple species from the ecosystem could lead to its collapse. One of the major threats to biodiversity is the introduction of non-native species. Non-native species are organisms that are not originally from the area, but are introduced by humans either accidentally or on purpose to solve a challenge. However, non-native species often times become invasive species. Invasive species are non-native species that overtake and outcompete native species in an environment often displacing and disrupting the balance of native ecosystems as they have no natural predators to keep them in check. When invasive species crowd out native species they lessen the biodiversity in an area and may eventually become the only species in the ecosystem.

Invasion of Reptiles in Florida

Florida alone has 50 non-native reptiles living in its midst, more than anywhere else in the world. Though a lot of them are thought to have arrived here as unintentional passengers aboard cargo ships, the pet trade has also contributed non-natives to the state as pet owners release them into the environment for a variety of reasons. Green iguanas (*Iguana iguana*), native to Central America, Southern Brazil, and the Caribbean islands, were introduced via cargo ships as well as through the pet trade and have wreaked havoc on South Florida native vegetation. The Argentine black and white tegu (*Salvator merianae*), introduced through the pet trade, are opportunistic omnivores which not only eat native vegetation but also native birds and mammals. The Burmese python (*Python bivittatus*) was introduced into the Everglades via the pet trade from its native habitat in Asia. It has become an invasive species that gets so large it has actually been found to eat alligators, which is one of Florida's native reptiles. Thus, it is now actively being hunted in the Everglades for its removal. This problem is not limited to large reptiles, but many smaller lizards as well, including the anoles (*Anolis*, see Story Highlight for more information). The introduction of these invasive reptiles has done harm to Florida's native ecosystems in many different ways, crowding out native species, decimating native vegetation, and costing the state millions of dollars in removal.



Argentine black and white tegu (*Salvator merianae*)



Burmese python (*Python bivittatus*)

Citizen Science Initiatives: City Nature Challenge

Scientists use a variety of methods to gather data. Through citizen science, people of all backgrounds and ages can have the opportunity to collaborate and contribute to scientific research. Citizen scientists can help collect or analyze data, develop methods for collecting data, or communicate results. This method of collecting data is particularly useful when researcher's need a great amount of data over a period of time or across a large distance. The City Nature Challenge is an international BioBlitz competition (an intense period of biological surveying in an attempt to record all the living species within a designated area), which promotes people from all around the world to document nature in their city. The BioBlitz takes place over a four day period in the Spring season and encourages community members to explore their local environment and discover the nature all around them. By using the citizen science application or website [iNaturalist](#), participants can upload photos of the nature that they find, including plants and animals. Each observation helps contribute to the City Nature Challenge and environmental science data that scientists can openly access for their research.

Key Vocabulary

Adaptation – the process that an organism goes through to become better suited to their environment

Biodiversity – the variety of life that exists within an ecosystem

Citizen Science – incorporating amateur scientists (citizens) in the scientific process to aid with the research of professional scientists

Ecosystem – a community of living creatures and nonliving things interacting and forming relationships within a given space

Invasive Species – an organism that is not native to a particular area, but has overtaken the area and its resources

Native Species – an organism that is naturally occurring in a particular area

Non-native Species – an organism that lives outside of its native area as a result of deliberate or accidental introduction

Story Highlight

Twenty years ago green anoles (*Anolis carolinensis*) used to be found abundantly in South Florida from backyards to gardens and even schoolyards. Nowadays brown anoles (*Anolis sagrei*) are the most common anole found in these same areas. These invasive lizards are originally from Cuba and the Bahamas and were first detected in the 1880s in the Florida Keys, most likely from hitchhiking in a cargo ship. By the 1940s they had become established in South Florida. Cuban brown anoles compete directly with green anoles for both food and shelter as well as have been documented to demonstrate aggressive behavior towards green anoles, making them an invasive species that is currently changing the balance of anoles in the ecosystems throughout South Florida.



Green anole (*Anolis carolinensis*)



Brown anole (*Anolis sagrei*)

Materials (per student)

- Reptile Survey Worksheet (page 8)
- Writing Utensil
- *Optional: Smartphone, tablet, and/or computer with camera and iNaturalist app*

Project Procedure

Please note that this project can be done in small groups or individually.

- 1. Introduction: Native versus Invasive Species:** Begin lesson with discussion about native versus invasive species and the issue of non-native reptiles in Florida by asking the following:
 - a. What is a native species?
 - b. What is a non-native species?
 - c. What is an invasive species?
 - d. Why are invasive species a problem?
 - e. Why is Florida potentially more vulnerable to non-native reptiles in particular?
 - f. What consequences could this have for native species?

Introduce the story of the invasive Cuban brown anole and the native green anole.

- 2. Begin Research Project:** Students will research the effects of the introduction of the Cuban brown anole on the native green anole.

Discuss and provide students with tips on good researching practices, including:

- a. Look at the date the information was published, is the information current?
- b. Do not give away any personal information, be wary of any website that asks for your name, address or more.
- c. Check the source of information for an expert, notable organization or government agency.
- d. Consider the information provided and check for accuracy, importance and social and cultural context.

Suggest the following sources to students for their research:

- a. [Anole Annals](#)
- b. [Field Identification Guide for the Anole Lizards of Miami](#)
- c. [iNaturalist](#)
- d. [Savannah River Ecology Laboratory](#)
- e. [UF IFAS Gardening Solutions](#)

- 3. Visualizing Data:** Students will be presented with the following data chart, noting a reptile survey done by Dr. Todd Campbell on Mosquito Lagoon, Florida:

Year	Green anoles	Brown anoles
1996	125	18
1997	12	300

1. Students will create a bar chart for each year and consider the following:
 - a. What changes are observed from one year to another?
 - b. What could be a possible explanation for this decline in green anoles and increase in brown anoles?
 - c. *Remind students to provide an x-axis, y-axis and graph title!*
- 4. Reptile Survey and Data Collection:** Students will conduct their own reptile survey in their backyard, school property, or in a nearby public area. In preparation for their reptile survey, students should consider the following:
 - a. Wearing appropriate clothing while outdoors, including long pants, long sleeve shirts and a hat.

- b. If the student is working on the project at home, it is recommended that they work with a partner (family member, friend or classmate) for safety purposes.
- c. Consider the time of day that surveying is taking place. Reptiles tend to “bask” or absorb heat in the mornings or late afternoons.
- d. Choosing a sampling site that tends to be sunny, sheltered and relatively undisturbed. This can be a local nearby area (home, park or school).
- e. Students are to use the Reptile Survey Worksheet to tally the count of brown anoles, green anoles and other reptiles they encounter during their survey. Data may look like the following:

Reptile #	Notes and Possible Identification	Count
1	Brown Anole	5

- f. Students are encouraged to use iNaturalist, if able, to help them identify reptiles. Then they should add if the reptile was identified by name and whether they are invasive, non-native or native.
 - g. The survey of the same area should be conducted three times to provide a better analysis, keeping as many variables the same as possible (e.g. time of day, weather, sample site, length of time surveying).
- 5. Analyze Collected Data:** Students will analyze their data by visualizing it on a bar graph and through basic statistics to analyze results across samples on their Reptile Survey Worksheet. Students should consider the following:
- a. How many reptiles were found?
 - b. What reptile had the largest population in the samples?
 - c. Calculate the mean, median, and range of population counts in your samples for each type of reptile. What do those numbers tell you about the sample population? Are they all equally useful to understanding the data?
 - d. Why may there be more of a certain species in this area versus another?
 - e. Do you think your sample populations are representative of the larger population in South Florida?
- 6. Compare and Contrast:** Students should then compare the findings of their survey to the data provided in Step 3 (page one of the Reptile Survey Worksheet).
- a. How does their survey compare? Are the findings similar to the data for either year?
 - b. Are they different?
 - c. If they did differ, why do you think that is?
 - d. Is there research information available that suggests another reason that green anoles are no longer in areas they were previously abundant?
 - e. What additional research would need to be done to further explore this topic?
- 7. Presentation and Reflection:** Students will put together a presentation showcasing their data findings and comparisons. Students are free to choose how they would like to present these data visualizations to their classmates (PowerPoint, poster board, printouts, etc.). Student presentation should include:
- a. Charts from the data provided (Step 3)
 - b. Charts from their reptile surveys
 - c. Statistical analysis of reptile survey
 - d. Inferences about the results from their samples compared to the larger population of South Florida and the data provided.
- 8. As a class, encourage students to share their presentations with their classmates and discuss the following:**
- a. How are their findings similar or different?
 - b. Are green anole populations reduced due to the introduction of the invasive Cuban brown anole into the South Florida environment?

Optional Extension

As an optional extension, students may choose to participate in the City Nature Challenge scheduled to take place between April 30 and May 3, 2021. To participate students need to follow these steps:

1. Look for wildlife (plants, reptiles, insects and other animals) throughout their local community and environment between April 30 and May 3.
2. Take a picture of what they find making sure to note the location of their finding.
3. Share their observations by uploading them to iNaturalist.org.
4. Monitor the tally of observations to see which city wins!

Students can connect with City Nature Challenge South Florida organizers by using the hashtag #CNCSoflo and joining our project on iNaturalist at

<https://www.inaturalist.org/projects/city-nature-challenge-2021-south-florida-cncsoflo>

Notes/Considerations

For English language learners, we recommend reviewing this article for helpful tips: <https://www.cambridge.org/us/education/blog/2019/08/29/unlocking-science-english-language-learners-part-three/>

While students are completing their surveys, they should practice safety precautions like wearing proper footwear (closed toe shoes), be aware of any allergies to plants and insects, and not venture onto any private property except their own during the survey.

Additional Resources

- Anole Annals - <https://www.anoleannals.org>
- Florida Fish and Wildlife Conservation Commission (List of nonnative reptiles) - <https://myfwc.com/wildlifehabitats/nonnatives/reptiles/>
- Field Identification Guide for the Anole Lizards of Miami - http://www.jameststroud.com/uploads/2/6/1/3/26134722/kolbe_et_al_2014_-_field_identification_guide_for_the_anole_lizards_of_miami.pdf
- iNaturalist - www.inaturalist.org
- The War of the Lizards, Sun Sentinel - <https://www.sun-sentinel.com/news/fl-xpm-1997-11-02-9710310199-story.html>



Argentine black and white tegu (*Salvator merianae*)

Reptile Survey Worksheet



Student Name: _____

A reptile survey done by Dr. Todd Campbell on Mosquito Lagoon, Florida in the late 1990s produced the following counts. Plot the results on the graphs below. Remember to label your x and y axis.

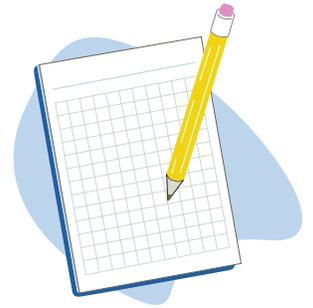
Year	Green Anoles	Brown Anoles
1996	125	18
1997	12	300

Brown vs. Green Anoles in Mosquito Lagoon, FL (1996)



Brown vs. Green Anoles in Mosquito Lagoon, FL (1997)





Now conduct your own reptile survey three times and analyze the results. Try to keep the conditions the same when you conduct your survey (e.g. time of day, weather, sample site, etc.)

Data Collection Log #1:

Reptile #	Notes and Possible Identification	Count

Data Collection Log #2:

Reptile #	Notes and Possible Identification	Count

Data Collection Log #3:

Reptile #	Notes and Possible Identification	Count



Data Analysis (Part 1):

First, compile your data using the log provided below.

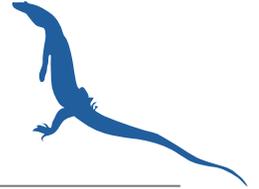
Reptile	Count from Log #1	Count from Log #2	Count from Log #3

Then calculate mean, median, and range for each reptile.

Reptile	Mean	Median	Range

Graph the count from each log below. Remember to label the x and y axis, graph title, and provide a key if necessary.





Data Analysis (Part 2):

1. How many reptiles were found?

2. What reptile had the largest population in the samples?

3. What do the mean, median, and range tell you about the sample population? Are they all equally useful to understanding the data? Provide support for your answer.

4. Why may there be more of a certain species in this area versus another?

5. Do you think your sample populations are representative of the larger population in South Florida? Provide support for your answer.

Compare and Contrast: How does your survey compare to the data from the reptile survey done by Dr. Todd Campbell on Mosquito Lagoon, Florida? Why do you think they are similar or different? What additional research would need to be done to further explore this topic?

Please use additional pages as needed.
